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ABSTRACT

Major changes in postgraduate education since the 1970s in countries belonging to the Organisation for Economic Cooperation and Development (OECD) are examined. Postgraduate education refers to specialized or research training after the receipt of a university degree. The basis of analysis includes: analyses provided by authorities in Australia, Finland, France, Japan, Greece, Sweden, Switzerland, the United Kingdom, and the United States; visits to France and Sweden; and case studies of the Netherlands and Norway. Attention is directed to: the changing scale and structure of post-graduate education, the changing composition of the study body, financing postgraduate study, institutional location, the duration of research training and the issue of noncompletion, and employment/unemployment of higher degree graduates. Information is provided on: postgraduate enrollment data for six countries for 1973-1983; degrees awarded by field of study; the participation of women in postgraduate studies; the age of postgraduate students; foreign student enrollments; student financial aid policies; and the number of U.S. employed doctoral scientists and engineers by field, sex, sector of employment, and primary work activity, 1973-1981. (SW)

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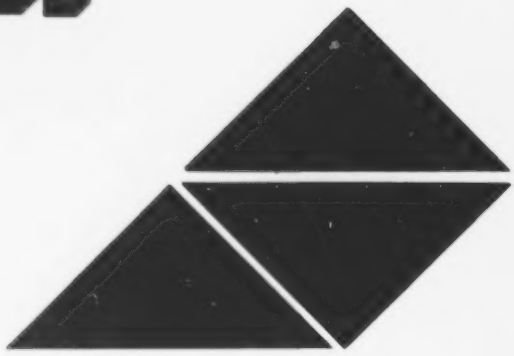
POST-GRADUATE EDUCATION IN THE 1980s



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POST-GRADUATE EDUCATION IN THE 1980s

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to article 1 of the Convention signed in Paris on 14th December, 1960, and which came into force on 30th September, 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries acceded subsequently through accession at the dates hereafter: Japan (28th April, 1964), Finland (28th January, 1969), Australia (7th June, 1971) and New Zealand (29th May, 1973).

The Socialist Federal Republic of Yugoslavia takes part in some of the work of the OECD (agreement of 28th October, 1961).

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This report has been prepared in conjunction with the broader study on the role and functions of universities, undertaken in response to the recommendations of the OECD Intergovernmental Conference on Policies for Higher Education in the 1980s (OECD, 1983) and published under the title *"Universities under Scrutiny"* (OECD, 1987).

Post-graduate education has always been a distinctive feature of universities and also a major concern of science and research policies. Since the OECD last reviewed this field – *Post-graduate Education: Structure and Policies* (OECD, 1972) – significant changes have taken place, in both higher education and science policies, which have profoundly affected the scale and shape of post-graduate education over the last fifteen years on which this report focuses. This new situation derives from the decline of the growth of higher education, which had characterised the euphoric sixties, as well as changes in the composition of the student body and in the employment prospects of higher degree graduates, and also from more restrictive approaches to the funding of research consequent on the growing concern with efficiency, relevance and the setting of hard priorities.

The impact of these changes is analysed in the various chapters of the report, based on information provided by Member countries themselves and from the available literature. The main conclusions are summarised in the final chapter.

The report has been written by Prof. S. Blume and Mrs. O. Amsterdamska, of the University of Amsterdam, in close collaboration with the Secretariat. It is published on the responsibility of the Secretary-General of the OECD.

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Chapter 1

INTRODUCTION

Until recently post-graduate education (in the sense of specialised or research training following on receipt of a university degree) was rarely the subject of specific policies. An important reason for this was that post-graduate education – and particularly research training – was subject to two sets of policy interests – higher education and science policy – with different concerns and priorities and rarely adequately co-ordinated. Comparative analysis of the problems and structures of post-graduate education was also beset by difficulties, and remains so, due to major problems of definition. Professional training, for example, in fields such as education, medicine, law, sometimes includes a formal, post-graduate level of study within the university, and sometimes it does not.

A further set of definitional problems derive from the structure of degrees in the various Member countries. The 19th century German idea of university study, which of course was a dominant influence in the development of higher education in many European Member countries, was based upon the notion of becoming a scholar: it was a preparation for a life of scholarship. The doctorate was the natural end of such studies, and represented the successful completion of an apprenticeship in scholarship which necessarily took many years. Over the course of the past century, of course, intermediate steps have been established and formalized, marking with appropriate qualifications the completion of different cycles of higher educational study. But the final stage, leading to the doctorate, has developed very differently in various countries. Many countries, following the United States, have made of it a distinct formal cycle of education, differing only in terms of its *level* from those preceding. In other countries, such as the Netherlands, it has continued to be seen as an apprenticeship in scholarship: not "education", but the arduous process of becoming a member of the community of scholars. The earlier stage of study is marked, for the successful student, by receipt of the degree of *doctorandus* – one who is becoming a doctor. Yet other countries, such as France, have combined the two systems, so that (until very recently) in France it has been possible to obtain either a "short-cycle doctorate" (*doctorat de troisième cycle*) or the traditional doctorate – taking many years – the *doctorat d'Etat*. The earlier stage too has been variously divided up, and there is a set of intermediate degrees (master's degree, *diplôme d'études approfondies*, etc.) differing not only between countries but frequently between fields of study within a country. These intermediate degrees may or may not be required for admission to doctoral study.

Sweden exemplifies the complexity of the degree structure. Until 1969 post-graduate study in Sweden was divided into two stages: the licentiate degree and the PhD. The licentiate degree, involving set reading and the preparation of a thesis, was a required step towards obtaining the PhD. When in 1969 the PhD was remodelled along the lines of the American system, the licentiat was abolished as a compulsory intermediate stage of training. Very recently, however, a *new* licentiat degree has been introduced by many (though not all)

faculties. But its function is very different from its predecessor with the same name. The new intermediate degree was prompted by employment considerations: the need in certain fields for people with advanced training and some knowledge of research methods. This shift over fifteen years, from a licentiat reflecting the perceived exigencies of scholarship to a licentiat reflecting the perceived exigencies of the labour market, encapsulates much that has happened in the field of post-graduate education, not only in Sweden but in the OECD area as a whole.

Today, in contrast to a decade and a half ago, post-graduate education is a specific area of policy concern in a number of Member countries. Though the form of this concern differs from one country to another, it is, to a very considerable extent, employment considerations – the "needs" of certain areas of technology seen as economically vital – which have produced this crystallisation of concern. This perspective began to take shape in the 1970s. In Britain, when the government of the day published its observations on a 1973-74 Parliamentary report on post-graduate education, it made its concerns clear:

> "...The Government broadly accepts the view of the Expenditure Committee that 'postgraduate education should be shaped, not by student demand alone, but principally by the needs of the economy and of society as a whole'. Institutional demand, though it must receive due recognition, clearly cannot be regarded as the overriding objective. The Government believes that a system primarily designed to satisfy individual demand would be too haphazard a way of meeting manpower needs. Accordingly, they agree with those who urge that resources for postgraduate education should be provided primarily in order to meet the country's need for trained manpower."

But not only were circumstances in the mid-70s very different from those of today, so too attitudes and expectations – still very much rooted in (or reacting to) the experiences of the 1960s – diverged even more from the present day situation[1].

At the beginning of the 1970s post-graduate education (and particularly that aspect of it dealing with research training) was growing rapidly, both in terms of output (of particular interest to science policy-makers concerned by the manpower needs of the research system) and in terms of enrolments and transition rates (of interest to higher educational planners). Through the 1960s, the output of PhDs in the United States had expanded at nearly twice the rate of expansion at the bachelors level; in Japan the expansion had been four times as great. In almost all OECD countries this phenomenon occurred to a greater or lesser extent. What had to be explained, in analysing the structures and policies of post-graduate education, was *growth*. How had research training come to grow at such a rate? An OECD study of 1972 *(Post-graduate Education: Structures and Policies)* tried to explain the phenomenon of growth in terms of the following factors:

- Growth in student demand;
- Growing specialisation of knowledge;
- Demand (or perceived demand) for scientific manpower;
- The institutional dynamics of the higher education system itself (in particular the increase in funds for research which had taken place through the 1960s).

The intervening period has, of course, seen an end of growth in the higher education system as a whole[2]. But it is not only in this respect that the circumstances of post-graduate education have altered since the earlier enquiry was carried out.

The various country reports on *The Role and Functions of Universities* show clearly that the structure of the student body has changed greatly over the past decade or two. The percentage of women as enrolled students has in almost all countries continued to rise (with many countries now clustering around the point of equality). In many countries, and partly in

response to facilitation of admission of mature students, the student body has grown older. A further factor here, having implications to be considered later in this report, is a growing tendency (most marked in the United States) for students to return to post-graduate work after some years of work experience.

The employment situation, not least for graduates, has changed drastically. The national case studies show that, whilst graduate unemployment is generally considerably below that for the labour force as a whole, it is nevertheless significant, with rates of 7-10 per cent not uncommon. As stated in a recent OECD study, these circumstances have had profound implications for the universities.

> "With the changing labour market situation the dominance of strictly academic criteria has declined at the same time as growing importance is being assigned to the employment value of different types of higher education. Thus a different order of preferences seems to have emerged: the ranking of institutions and programmes in the new pecking order is still conditioned by their academic standing but also, and to a far greater extent than in the past, by their *perceived job relevance*".[3]

There are implications, too, for the demand for post-graduate study. There is little doubt that, in the past, graduates have, as it were, taken refuge from a world offering little opportunity by continuing their studies. But the extent to which this has been true, and is of consequence today, is a difficult question.

Following, perhaps less strictly and for different reasons, the lead established by Sweden in the early 1970s in *integrating* post-secondary education institutions, the barriers between universities and non-university institutions have, to a certain extent, broken down. The universities have in some cases been compelled to come to see themselves as only part of a broader system. The Australian national report spells this out very clearly:

> "Universities are now seen as part of a more comprehensive system of tertiary education. They are thus expected to play a complementary role to institutions in other sectors ... universities are now part of a federally-funded and reasonably tightly co-ordinated national system. They still enjoy considerable autonomy, but their freedom to act independently has been considerably eroded ..." (Australian Report, paragraphs 18-19).

However, it should be added that the capacity and the willingness of universities to change their role in the light of changing social priorities vary profoundly from one national system to another. In some cases it is clear that universities are perhaps most aware of the continuities in their traditional responsibilities, and take the view that adaptation to what may be a temporary conjuncture is best left to other elements in the system. The report from the United Kingdom suggests this is true here:

> "On the whole the UGC consultation exercise and its strategy document shows that British universities see themselves as maintaining their traditional functions and their traditional academic excellence during the rest of the century. Whether this will be sufficient will be known only after the event. Increasingly, new developments in providing new kinds of courses for new kinds of students seem likely to come from outside the conventional universities."

Science policies have been of major importance. Through the 1970s funds for research declined drastically in many countries, as governments cut back on expenditure in almost all policy areas. More recently, research – in certain narrowly-defined areas – has again come to seem of major economic importance. In fields such as micro-electronics, biotechnology, materials science, funds are once more lavishly available. To some degree these funds are

being provided by industry, and university/industry research relations represent an area of science policy concern in which numerous innovative initiatives are being taken[4]. Catchwords of science policy today are "efficiency" and "relevance".

The graduates emerging from earlier cycles of higher education, and who thus form the pool from which entrants to post-graduate study needs must be drawn, constitute a group which differs in many respects from its predecessors. It is true that the group of "graduates" tends to bear less of the mark of social change than the student population as a whole (e.g. the national case study for the United States shows that women and minorities have not succeeded in earning bachelors degrees in proportion to their representation among enrolments). Nevertheless, they are typically older, and they enter a world in which prospects are much changed.

All of these developments have had major implications for the scale, the nature and the structure of post-graduate education which differs in all of these respects (and in the policy problems which it now appears to present) from the situation a decade or so ago.

Today, then, post-graduate education is a major and explicit concern of policy-makers in a number of Member countries. However, as this report will show, the *senses* in which this is so – the particular concerns of policy-makers and the initiatives taken – differ widely. In Greece and in the Netherlands, for example, what is at issue is the introduction of a formal post-graduate education: the attempt to formalize, to professionalise the process of research training. In France and Sweden, which travelled that road long ago, the issues are different. In France recent reforms have as part of their objective attempted to make research training more efficient, but at the same time more internationally "marketable". In Sweden efficiency is also a concern, but related in particular to the unacceptably long time typically taken to obtain the doctorate and the very high non-completion rates in many fields.

The volume and the quality of the information provided by many Member countries bear witness to the significance of the issues addressed here. The present report is based upon *i)* country statements on *The Role and Functions of Universities*; *ii)* materials and special analyses provided by the authorities of Australia, Finland, France, Japan, Greece, Sweden, Switzerland, the United Kingdom and the United States; *iii)* visits to France and Sweden; and iv) special case studies of the Netherlands (written by Ruud Grondel of the University of Amsterdam) and of Norway (prepared by S. Kyvik, of the NAVF Institute for Studies in Research and Higher Education, Oslo).

Chapter 2

THE CHANGING SCALE OF POST-GRADUATE EDUCATION

The *demand for admission to post-graduate study* is nowhere available from routinely collected data. It refers to the numbers of students seeking admission independently of the numbers actually admitted (which may of course differ on account of lack of capacity, inadequate quality of some of the applicants, failure of some students to obtain financial support, decision to postpone entry, etc.). In the United Kingdom a survey of the heads of university departments was carried out in connection with a recent report on post-graduate education by the Advisory Board of Research Councils. In this survey, heads of departments were asked how many applications they had received for the academic year 1978-79 for scientific post-graduate training[5], and these figures were set against the numbers of those whom they actually accepted, to produce a "total" demand ratio. For research students in universities this produced figures (full-time plus part-time) as follows:

Engineering	Biological science	Physical science	Social science	All
2.7:1	4.2:1	3.0:1	3.6:1	3.4:1

However, when an attempt was made to correct for the fact that many students might have applied to more than one department, it appeared that this ratio had to be divided by two. In other words, the Working Group concluded that the total demand ratio was only about 1.7:1. Comparable data for other Member countries are not available. In the United States there is a widespread opinion that students are increasingly foresaking graduate research training for professional schools offering MBAs and law or medical qualifications. Moreover, as the economist William Bowen, President of Princeton, points out, it may be, in particular, the very *best* of students who decide *not* to enter into research training. In the social sciences and humanities the rate of admission has increased to maintain numbers. Bowen writes:

> "Qualitative data are notoriously hard to come by, but fragmentary evidence suggests that, in fact, there has been a marked decline in the number of truly outstanding students seeking PhDs in the arts and sciences. We know that applications are falling and that admit rates are rising. At the 20 universities included in the recent COFHE analysis (and this group includes many of the leading departments), the changes over the last seven years are striking. For these highly selective institutions, the admit rate has risen from 35 per cent to 43 per cent in the humanities and from 25 per cent to 33 per cent in the social sciences; at the same time, the admit rate for engineering has dropped from 64 per cent to 46 per cent. Part of the problem, it seems clear, is the rapid increase in the effective net cost of graduate education (including opportunity costs) for the ablest students. Whatever the full gamut of reasons, my own intuitive sense of what is happening to quality was reinforced by the impressions that Robert Goheen, Director of the Mellon fellowship program in the humanities, conveyed in his report on meetings he held with faculty members all across the country last fall. Dr. Goheen noted:

Table 1. **Enrolments in post-graduate education**

	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1982-83	Average annual growth rate %
Australia					19 139[5]		20 538[3]		23 500[6]	4.1
Finland	5 041[1]			5 029[2]			5 737[3]			2.1
France[4]		68 931				78 841	86 076			4.4
Sweden			11 609		12 193			12 147		0.9
United Kingdom										
Universities[7]			73 128		74 184			76 971	75 724	0.4[a]
Advanced F.E.			11 781		11 924			15 784		1.0[b]
Total			84 909		86 108			92 755		6.0
United States		1 086 334		1 076 980				1 102 374		0.3

1. 1973.
2. 1977.
3. 1980.
4. Excluding students of medicine included in French statistics. Including these, figures are:

1974-5	1978-9	1979-80	1980-81	% growth
93 480	106 649	121 498	128 410	5.2

5. 1978.
6. 1983.
7. England and Wales only.

Source: Compiled from national statistics.

> With only a very few exceptions, at each place I had confirmed again that many of their brightest undergraduates have not been going on into graduate study recently. Many admitted that they had not been encouraging even the very able to do so. Some said talking down of career prospects in academia was widespread among their colleagues ..... (There was) a widely shared perception that they are encountering noticeably fewer very bright, very challenging graduate students than ten years ago and on the whole the quality was down at the graduate level.
>
> Institutional studies at Northwestern, Harvard, Chicago, and other strong institutions show a sharp drop-off in the fraction of those students elected in Phi Beta Kappa who choose to pursue academic work"[6].

Few data on *new entrants* were made available. Data for Sweden show more or less stable numbers between 1975/76 and 1980/81 (i.e. zero growth); for the United Kingdom, a very small decline over the same period (approximately -0.2 per cent per annum). Only in the case of Australia, among the three countries for which this indicator is available, was there clear growth through the late 1970s. Between 1978 and 1983 the number of new entrants to post-graduate study in Australia grew at approximately 4.5 per cent per annum.

Table 1 provides *enrolment data* for six countries. What this shows is that in some countries little or no growth in post-graduate enrolments occurred through the late 1970s. These include Sweden, the United States, and the *university* sector in the United Kingdom (although in the latter country it appears that expansion *did* take place in the non-university sector). By contrast there was a rather rapid growth – of the order of 4 per cent per annum – in Australia and France. Finland falls in between.

Far more comprehensive information is available on the *numbers of advanced degrees* awarded. This information is provided in Tables 2 and 3, by broad groupings of fields of study. There are a number of conclusions to be drawn from Table 2, which relates to doctorates awarded.

In the first place it is clear that, just as suggested by admissions data, different situations obtain in different countries. In a first group of countries, including Finland, France, Norway and the Netherlands, the total numbers of doctorates awarded have been growing fairly consistently through the late 1970s and into the 1980s. In a second group of countries there has apparently been a gradual decline in numbers. This group includes the United States (where, however, the number of PhDs in science and engineering have again begun to rise from the beginning of the 1980s), and perhaps the United Kingdom (though PhD numbers are no longer reported separately). Standing between are Japan (where there appears to have been slow growth until 1982 followed by a sharp drop in numbers), and Sweden and Australia.

It is also possible to look at the various groupings of disciplines and ask to what extent these trends are shared. Indeed, major differences may occur in the growth patterns of, for example, science and engineering on the one hand and the humanities on the other. Unfortunately the data do not permit clear conclusions on this point. Certain features stand out however. In the case of Finland, it is apparent that most of the growth is attributable to the natural sciences and the medical sciences. In the Netherlands, it would appear that it is the social sciences and the health-related sciences which account for most of the growth, whereas the natural sciences and engineering have scarcely grown. In the United States the data (Table 2) do not permit significant conclusions, though it appears that the health sciences and education escaped the downward trend witnessed by the humanities, the social sciences and the natural sciences/engineering together. A clearer picture for the United States is provided by Figure 1. Although the categories are somewhat different, it suggests that whereas

Table 2. **Doctorates awarded, by field of study**

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Australia									
Total			846		886			953	
Finland	[4]		[5]				[6]		
Humanities	27		33				31		
Social Science[1]	23		30				34		
Science[2]	87		102				125		
Health[3]	83		94				100		
Education	1		7				10		
Total	221		266				302		
France[10]									
Humanities[7]	1 515	1 130	1 563			1 867	2 307	2 099	
Social Science[8]	895	822	858			1 100	1 241	1 037	
Science	3 465	3 374	3 242				3 925	3 916	
Total (excl. Health)	5 875	5 326	5 663				7 473	7 052	
Health							290	313	
Japan[9]									
Humanities					299	316	295	347	309
Social Science					229	210	203	217	176
Science					837	843	898	949	790
Other					64	70	61	52	60
Total (excl. Health)					1 429	1 439	1 457	1 565	1 335
Health					787	866	919	1 139	1 310
Netherlands									
Humanities						66	82	105	
Social Science						99	141	157	
Science						423	445	440	
Health						236	293	323	
Other						8	4	1	
Total						832	965	1 026	
Sweden		[11]		[12]			[13]		
Humanities		81		94			80	97	
Social Science		132		108			106	110	
Science		329		331			339	357	
Health		218		202			287	368	
Total		760		735			812	932	

mathematics, the physical sciences and engineering suffered continuing decline through the last part of the 1970s, the situation in the life sciences and the social sciences are somewhat more favourable. In the case of France there are no clear differences between fields of study.

Table 3 provides more limited data on non-doctoral higher degrees awarded. This includes master's degrees and their equivalents as well as degrees involving a somewhat longer period of study (for example the French *diplôme d'études approfondies*, DEA, and the *diplôme d'études supérieures spécialisées* or DESS) which, according to the French Ministry of National Education, are equivalent to one year of post-master's level study. These may be wholly taught or involve a research component; they provide an initial stage of what will become doctoral study or a specialised knowledge of use principally in employment. Data are more limited in that a number of countries do not have such intermediate degrees. What the data show, however, is that where such degrees do exist, it is here – more than at the doctoral

Table 2. **Doctorates awarded, by field of study** *(continued)*

	1975	1976	1977	1978	1979	1980	1981	1982	1983
United Kingdom[14]									
Humanities	668		589						
Social Science	546		612						
Science	3 486		3 482						
Health	460		426						
Education	65		76						
Other	31		29						
Total	5 256		5 214						
United States	[11]					[13]			
Humanities	5 146					4 465			
Social Science	8 545					7 912			
Science	11 672					11 467			
Health	577					842			
Education	7 769					7 900			
Other	355					372			
Total	34 064					32 958			

1. "Social science" in all cases includes law, business studies, economics.
2. "Science" includes engineering, technology, agriculture.
3. "Health" includes all medical and paramedical sciences, including dentistry. Professional qualification (e.g. American MD) are excluded.
4. Owing to small fluctuating numbers, Finnish authorities reported multi-year averages. These are 1971/2-1975/6; 1975/6-1979/80 and 1978/9-1982/3.
5. Ditto.
6. Ditto.
7. Includes "*lettres, sciences humaines*".
8. Includes "*droit/sciences politiques*" and "*science économique, gestion*".
9. Figures from which "*doctorats en médecine*" could be *excluded* (e.g. doctorats de 3e cycle in pharmacie, *doctorats d'Etat* in human biology) available only for 1981, 1982.
10. Includes "*doctorats d'Etat*", "*doctorats de 3e cycle*", "*diplômes de docteur ingénieur*".
11. Academic year 1975-6.
12. Academic year 1977-8.
13. Academic year 1980-1.
14. U.K. statistics of degrees awarded do not separate PhDs from other higher degrees after 1977.

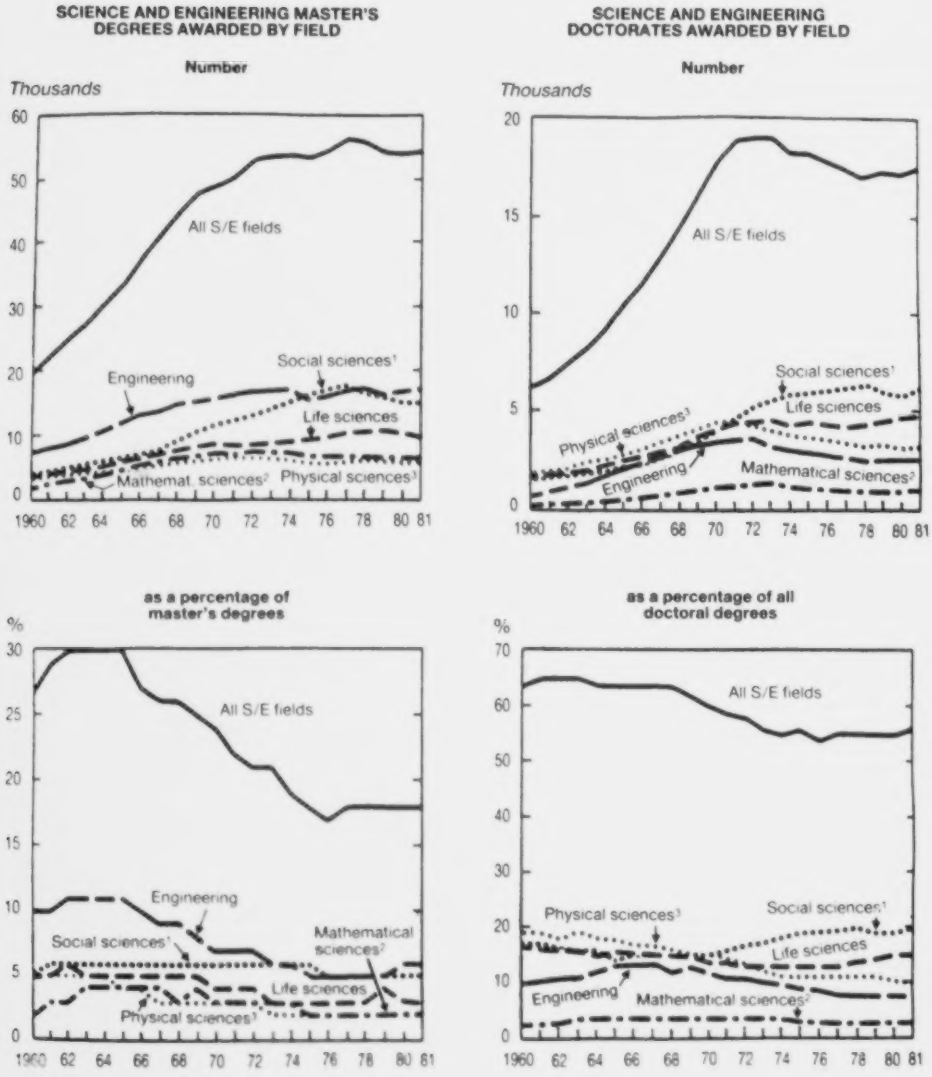
a) Japan reports "number completing courses", "including those who have acquired the required number of credits and left the course without obtaining a doctors degree".

Source: Compiled from national statistics.

level – that expansion has occurred. In Australia, France and Japan – the only countries for which rates of growth at the two post-graduate levels can be compared, it is at the intermediate – master's – level at which the more rapid growth has occurred. At this level, France had a growth rate of 8 per cent per annum over the period 1976 to 1982, Australia 6 per cent over the period 1978-83, and Japan 2 per cent over the period 1979-83. The picture here is in fact rather complicated, due to the variety of types of intermediate qualification available, to their market value, and to whether or not such a degree is a required step for obtaining a doctorate. In this respect policy in a number of countries has been marked by significant shifts. The abolition of the licentiat as a compulsory intermediate step, and its subsequent re-introduction in a different (and non-compulsory form) in Sweden has already been mentioned. In Finland, the licentiat was similarly a compulsory intermediate step (except in the medical sciences) until the end of the 1970s. New regulations from that time made it optional, so that the student may pass directly to the doctorate. Clearly, growth rates

Figure 1

UNITED STATES: HIGHER DEGREES AWARDED



1. Includes psychology.
2. Includes computer sciences.
3. Includes environmental sciences.

Source: *Science Indicators, 1982*, p.79.

Table 3. **Higher degrees awarded by field of study: Master's and professional**

	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Australia					1 234[1]		1 383[2]		
Finland[3]									
Humanities		59			55			54	
Soc. sci./business/law		65			67			63	
Sci./eng./agric.		190			207			201	
Other		9			17			22	
Total		323			346			340	
France[4 5]									
Law/polit.sci.[6]	1 831	1 990	2 986	2 926	2 787	3 031	3 014	3 158	3 555
Economics/management[7]	953	1 013	2 322	2 198	3 035	3 165	3 593	3 695	4 166
Letters/human science[8]	–	–	3 955	4 826	5 534	5 978	7 319	6 650	6 877
Science[9]	3 580	3 217	3 561	4 334	4 238	3 945	4 353	6 055	6 678
Total	6 364	6 220	12 824	14 284	15 594	16 119	18 279	19 558	21 276
Japan[10]									
Humanities						1 011	961	1 034	1 012
Soc. science						1 143	1 157	1 143	1 068
Sci./engineering/agric.						9 996	9 915	9 527	9 964
Health						558	565	700	728
Other						1 002	1 031	1 130	1 423
Total						13 710	13 429	13 534	14 195
United Kingdom[11]									
Humanities		1 508		1 422			[2 223]		[2 293]
Soc. sci/business/law		2 765		3 228			[4 192]		[4 767]
Sci./engineering/agric.		4 116		4 462			[8 167]		[8 292]
Health		503		577			[1 265]		[1 394]
Education		1 254		1 285			[2 080]		[2 395]
Other		494		558			[619]		[554]
Total		10 640		11 532			[18 546]		[19 695]
United States									
Humanities			2 786					23 996	
Soc. sci./law			98 195					110 374	
Sci./eng./agric.			38 190					38 759	
Health			12 556					16 515	
Education			127 948					98 381	
Other			5 244					7 672	
Total			311 791					295 739	

1. Calendar year 1978.
2. Calendar year 1980.
3. Figures are totals over indicated years.
4. Calendar years, thus: 1974, 1975, etc.
5. Health qualifications excluded. See Table 4.
6. DES to 1977; DESS and DEA from 1976. Diplôme de l'Institut d'Etudes Politiques excluded.
7. DES to 1977; DESS and DEA from 1976.
8. DESS and DEA from 1976.
9. DES to 1977, DESS from 1976; DEA from 1973.
10. Calendar years, 1979, 1980, 1981, 1982.
11. Calendar years, 1975, 1977, 1980, 1982. Figures for 1980 and 1982 include PhDs. Separate figures not available.

Source: Compiled from national statistics.

at this level are likely to be highly sensitive to regulations of these kinds. Other sorts of intermediate qualifications, designed to confer additional specialised knowledge of relevance for employment, or to provide instruction in subjects not taught at lower levels, are likely to attract students for other reasons. Enrolments and graduation rates are sensitive to other factors. Questions relating to the functions and utility of different forms of intermediate post-graduate degree will be taken up later in this report.

Increases in the number of intermediate post-graduate degrees are a consequence in part of increases in the number of post-graduate professional degrees awarded in such fields as medicine, law, engineering, and business management. Despite considerable differences in the organisation of professional training in the various Member countries and the variety of post-graduate degrees awarded in these fields, the last decade has witnessed similar developments in a number of countries (see Table 4). The most dramatic changes have taken place in the number of professional post-graduate degrees in business management and administration. In the United States, the increase in the number of master's degrees in business administration has been growing on average by 7.2 per cent per year; in Great Britain the number of post-graduate degrees in business administration and accounting has been increasing by 10.6 per cent per year, and in France the number of *diplômes d'études supérieures specialisées* in management and economics has been rising by some 11.5 per cent per year since 1978. In contrast, the number of advanced degrees awarded in engineering has remained roughly stable. The traditional professional fields of medicine and law have experienced a more modest but steady growth in the United States and Great Britain. In France also there have been considerable increases in the number of degrees in law and political science, but at the same time, the number of *doctorats d'Etat* in medicine has declined.

A final issue which can usefully be included in this broad statistical picture of the changing "shape" of post-graduate education concerns the balance between *full-time and*

Table 4. **Post-graduate degrees in professional fields**

	1975	1977	1980	1982
Great Britain				
Medicine, Dentistry and Health	963	1 003	1 265	1 394
Business Management and Accountancy	877	1 075	1 149	1 531
Law	302	367	440	591
Engineering	3 135	3 124	3 314	3 189
	1975/76		1976/77	1980/81
United States				
Medicine	24 620		24 371	28 727
Business Management (Master's)	42 620		46 545	58 018
Engineering (Master's)	16 342		16 245	16 708
Law	32 293		34 104	36 331
	1978		1980	1982
France				
Medicine (*doctorat d'état*)	9 327		8 935	8 392
Management and Economics (DESS)	1 971		2 286	2 874
Law and Political Science (DESS)	874		839	1 393

Source: Compiled from national statistics.

part-time study. In a number of countries, and particularly in the arts and social sciences, post-graduate study is predominantly a part-time activity. The consequences of this – and particularly the evidence that *part-time* post-graduate research training is much less likely than full-time training to lead to successful preparation of a thesis – will be taken up later. Clearly, much depends upon the nature of the connection with the university which the part-time student enjoys, the provision made for him or her, the environment in which his/her other work is carried out (and the relations of these other tasks to science). Table 5 gives available data on the share of students who carry out their post-graduate work on a part-time basis.

The table shows that the percentages of students are considerable: in Australia, in Sweden (if part-time students are taken as those having either a job outside the university *or* a teaching assistantship within it), in the United States they are of the order of 60 per cent. In the United Kingdom there is a clear difference between the universities and the public sector of higher education (polytechnics and colleges). In British universities the share of part-time post-graduates is relatively small – though increasing rather rapidly. British data show how in fact these percentages differ between fields: the situation is not likely to be greatly different for other countries. For universities alone (Great Britain), the share of part-time students among all post-graduates in 1982/83 was 49 per cent in arts and humanities, 37 per cent in social science and business studies, 44 per cent in health-related fields, 45 per cent in education and 30 per cent in science, agriculture and engineering. In Sweden, in 1981, the share of students who simultaneously had a job outside the university ranged from 68 per cent in medicine to 32 per cent in natural science (though 44 per cent in technology).

In Sweden, where there is evidence that part-time students are at considerable risk of not finishing their studies, many – including the National Audit Bureau – have taken the view that the number of part-time students should be considerably restricted. According to this

Table 5. **Part-time students in post-graduate study**

By year

	Percentage share of part-time students in total enrolment				
	1976	1978	1980	1981	1983
Australia		64	60		58
France					
Sweden[1]					
a)	45	45		46	
b)	68	67		68	
United Kingdom					
Universities	31[3]	33[4]		37[5]	39[6]
Advanced F.E.[2]	67[3]	67[4]		66[5]	68
United States[7]	63	64	60		

1. Sweden is given on a different basis: not by enrolment status but financial status. Thus (a) is share of post-graduate students financing their studies with a job outside the university; (b) is (a) + share having a teaching assistantship.
2. England and Wales only 1976-1981. England only 1983.
3. Academic year 1975-76.
4. Academic year 1977-78.
5. Academic year 1980-81.
6. Academic year 1982-83.
7. Students enrolled in degree programmes only.

Source: Compiled from national statistics.

view, a large number of "external" post-graduate students is a "risk factor": jeopardising the involvement of faculty in the progress of their students, reducing the prospects of having an active departmental seminar programme, over-diluting the use of resources, and so on. This view would make post-graduate study the fully-paid full-time occupation of a small group of students. There is another view, which has also been vociferously expressed in the Swedish debate. Many academics have objected to the view of part-time students as being a drain on resources and a source of inefficiency in the operation of the research training system. There has also been objection on the principle that post-graduate study is a cultural resource, which should be made available to as many people as possible.

Recent developments in Japanese policy have inclined rather to the latter view. The proportion of students carrying out post-graduate study or research on a part-time basis is small in Japan. Using financial support as an indicator, 31 per cent of graduate students in 1976 received an income from a job; in 1982 this figure was 29 per cent. In fact, it is relatively recently that part-time study for a master's degree (generally required for admission to a doctoral programme) has been legally possible. Only in 1983, the National Standard for the Establishment of Graduate Schools incorporated the following policy amendment: "wherever it is deemed necessary from an educational point of view, education in a master's course in the form of classroom instruction or supervision of research work or in other appropriate forms may be provided in the evening or at other certain times or periods". Programmes have now been introduced offering full-time study in the first year and then on a part-time basis in the evening in the second year.

The issues surrounding part-time study are complex. On the one hand, as discussed in Chapter 6, there is clear association with non-completion of post-graduate studies. In this sense, and viewed in relation to many current arrangements, part-time study is essentially problematic. On the other hand, it can be argued that part-time study provides the possibility of new means of integrating work experience and professional practice with research and advanced study. In this sense, part-time study has to be seen less as problematic than as a challenge to existing arrangements: a challenge which the universities will have to meet. The complexity inheres precisely in the relations between these two perspectives.

Chapter 3

THE CHANGING COMPOSITION OF THE STUDENT BODY

The various national case studies on *The Role and Functions of Universities* show a situation in which the undergraduate student population, from which post-graduates will be drawn, has changed significantly over the past one or two decades. In the United States, for example, the proportion of women among enrolled students has increased to nearly 53 per cent, the proportion of minority students (Blacks and Hispanics) has also increased, and the average age of enrolled students has also risen significantly (median age of all college students having risen from 20.7 in 1968 to 23.0 in 1982). But women and minorities are not equally distributed throughout the United States higher education system and – of great importance when one comes to consider the implications at the post-graduate level – their representation among *graduates* does not correspond to their representation among enrolled students. Thus, whilst black students made up 9 per cent of students enrolled in two- and four-year colleges, they were 6.5 per cent of all degree recipients. Something of the same phenomenon is to be observed for women students. But generally speaking, undergraduate populations now include more women and older students than a few years ago. To some extent – though not totally – these developments represent the consequences of positive discrimination policies, and policies designed to increase the possibilities for mature students to enter the university. To some extent other factors are at work. Ageing, for example, represents on the one hand the extension of opportunity, on the other a dragging out of studies so that the student remains enrolled for a longer period.

These developments are of double significance for the composition of the post-graduate student body. In the first place, in so far as what is involved is the implementation of specific policies, it may be anticipated that these policies will have also been applied at the post-graduate level. But beyond this, there are more general implications driving from the suggestions which have been made (and which certainly represent Swedish experience) that mature students and women students are less likely to be attracted to post-graduate study. Also relevant is the growing share of foreign students in a number – though far from all – university systems. The trend to internationalisation of the student population is most marked in the United States, where between 1960 and the early 1980s the enrolment of foreign students increased by some 9 per cent per annum. In 1980 fully 25 per cent of new entrants to higher education were foreign students ("non-resident aliens"): significantly concentrated in engineering and business-related fields. All of these trends are to be found also at the post-graduate level. There is however evidence that this growth is now slowing down.

Participation of Women

Increasing the rate of participation of women in university education, including post-graduate training, has been a stated policy goal in a number of countries. On the one

hand, these attempts are a part of broader policies aimed at increasing social equality; on the other hand, they reflect the need for attracting the most talented and diverse group of students to be trained for research and professional work. Concern with diversity in research has been explicitly given as a reason for increasing the participation of women in graduate education in Finland where, in 1983, the Council of State adopted a plan of a special working group on post-graduate education which stated:

> "The aim is to increase the proportion of women of all postgraduate students. The under-representation of women in research means that women's viewpoints are not represented in the selection of objects of study and in research work itself."

The American Commission on Student Financial Assistance, on the other hand, justified its recommendation of increasing the numbers of women in graduate education with a claim that "talent lost to graduate education is a loss to the entire nation". In evaluating the results of the various policies adopted in order to increase the participation of women in graduate education (such as, for example, special Title IX of the 1972 Higher Education Act in the United States which prohibits sex discrimination in all federally-supported education programmes), it is necessary to remember, however, that the increases in the number of women students reflect not only these policy initiatives but also the more general social changes which brought an ever-increasing proportion of women into the labour market.

During the last decade the proportion of women in the post-graduate student body has been increasing steadily in all the Member countries for which data have been made available. There have been increases in the proportion of women among new entrants, in the overall enrolment of women (Table 6), as well as in the proportion of post-graduate degrees granted to women (Table 7). Despite these increases, there are still significant differences in the participation rates of men and women: only in the United States the proportion of women in the post-graduate student body has approached the 50 per cent mark (though this number conceals the fact that still only some 30 per cent of all doctorates are awarded to women and that there are large disproportions among fields). Elsewhere, the proportion of women among graduate students has grown to about a third by the beginning of the 1980s. In Japan the proportion has been significantly lower – in 1983 only 12.9 per cent of post-graduate students were women. Similarly in Norway where only 11.2 per cent of doctoral degrees in 1984 were awarded to women.

Table 6. **Participation of women in post-graduate education**

Percentage

	1975	1977	1978	1980	1982	1983
Australia[1]			27.8	30.5		33.7
Finland[2]		30		35		
Japan[2]						12.9
Sweden[2]	22.8	23.5	24.0	25.1	27.3	27.9
United Kingdom[1, 2]	30.3	31.5		34.2	34.6	
[3]	25.4	27.2		30.2	31.2	
United States[2]	44.6	46.3	48.2			

1. New entrants.
2. Enrolments.
3. Universities only.

Source: Compiled from national statistics.

Table 7. **Participation of women in post-graduate education**

Percentage of women among graduates

		1975/76	1976/77	1980/81
United States	Master's	46.4	47.1	50.3
	Doctoral	23.3	24.8	31.5

		1971/72-1973/74	1976/77-1978/79
Finland	Licentiat	17	25
	Doctoral	13	16

		1975/76	1976/77	1980/81
Sweden	Doctoral	15.0	16.8	18.1

		1975	1977	1979	1980	1982
Germany	Doctoral	15.8	15.8	18.5	19.7	20.7

		1975	1977	1979	1981	1983	1984
Norway	Doctoral	5.6	8.5	10.0	9.2	12.2	11.2

Source: Compiled from national statistics.

However, the general figures on women's participation in post-graduate education – whether assessed in terms of enrolments or in terms of the proportion of degrees which are granted to women – conceal a much more complicated reality. For example, although the participation of women has increased in all fields, there are disciplines in which there are still very few women graduate students. In all countries for which such data were available, women are represented much more heavily in the humanities and the social sciences than in the natural sciences and engineering. In Sweden, for example, in 1980/81, women constitute only 8 per cent of entering graduate students in all the technological disciplines but as much as 46 per cent in the arts (see Table 8). The situation is similar in the United States where women receive 47.2 per cent of doctorates in education, 41.3 per cent of all doctorates in the humanities, but only 3.9 per cent of doctorates in engineering and 11.3 per cent of doctorates in the physical sciences (Table 9). Two-thirds of the recent gains in the number of doctoral degrees awarded to women in the United States can be accounted for by the increases in the social sciences and education. In Germany, 30.8 per cent of doctoral degrees in the humanities are awarded to women, but only 15.4 per cent in the natural sciences and only 2 per cent in engineering. The situation in Finland does not appear to be very different: women constitute some 63 per cent of graduate students in the arts and humanities and only 10 per cent in engineering (Table 10). These traditional differences between men and women might turn out to be of particular concern to the extent that women are heavily represented precisely in those fields which had experienced a considerable contraction and in which unemployment pressures have been the greatest. It is apparently in response to these disparities that in the recent past the National Science Foundation in the United States has sponsored programmes to encourage women to pursue graduate studies in science, while the National Commission on Student Financial Assistance has recommended that particular attention be paid to attracting women to those fields in which they are most heavily under-represented.

Table 8. **Sweden: Percentage of women in relation to new entrants to research training**

	1975/76	1977/78	1980/81
Theology	16	14	19
Law	19	20	28
Medicine	23	23	21
Dentistry	19	28	36
Arts	48	50	46
Social sciences	25	28	38
Natural sciences	13	22	23
Technology	8	11	8
Forestry	9	9	15
Veterinary medicine	20	31	43
Agriculture	13	16	19
Pharmacy	42	44	20
Stockholm School of Economics	9		27
Total	23	26	27

Source: Central Bureau of Statistics, Stockholm, data supplied by UHA.

Table 9. **Women receiving doctor's degrees, by field of study, as a percentage of total doctoral degrees**

	1975/76	1976/77	1980/81
United States			
Arts and humanities	34.3	36.3	41.3
Education	32.8	34.7	47.2
Engineering	1.9	2.8	3.9
Life science	19.5	20.1	26.4
Mathematics	11.3	13.3	15.4
Physical sciences	8.6	8.9	11.3
Professional fields	19.6	22.6	30.5
Social sciences	26.3	28.1	35.6
Total	23.3	24.8	31.5

	1975	1977	1979	1980	1982
Germany					
Humanities	21.4	25	27.3	27.3	30.8
Natural sciences and mathematics	7.7	7.7	8.3	8.3	15.4
Engineering	1	1	0.9	1	2
Health	21.3	21.4	26.4	26.3	25.8
Agriculture	10	13.3	20	23.3	25
Art	50	50	50	30	70
Total	15.8	15.8	18.5	19.7	20.8

	1975-1977[1]	1978-1980	1981-1983
Norway			
Humanties	9.5	20.6	22.6
Social sciences	16.7	13.4	12.5
Science	7.7	5.7	9.6
Health	4.6	13.1	9.0
Total	6.9	9.9	10.1

1. Because of small numbers involved, the percentages given cover doctorates awarded over three-year periods.
Source: Data supplied by national authorities.

Table 10. **Finland: Enrolment of women by field of study**

As percentage of total enrolment

	1977	1980
Arts	65	63
Law, social and behavioural sciences	32	40
Engineering	6	10
Natural sciences	31	34
Health	24	31
Agriculture and forestry	36	45
Total	30	35

Source: Data supplied by Ministry of Education, Helsinki.

Studies done in the United States and in Sweden indicate that women take longer to complete their degrees than men and have higher non-completion rates. It is impossible to ascertain from the available data whether this is true also of other Member countries. It might be noted, however, that the American study saw part-time enrolment of women, their greater reliance on self-support and their family responsibilities as the reason for this difference in the performance of male and female graduate students. A Swedish study on the situation of women graduate students also indicated that women with children and family experienced considerable difficulties in research training.

As mentioned previously, part-time post-graduate training constitutes an important and complex issue in educational policies. Since part-time enrolment of women has been cited as one of the reasons for their lower completion rates it seemed pertinent to inquire whether women are more likely than men to pursue their post-graduate education on a part-time basis. As Table 11 indicates, this is the case in the United States where in 1981 women accounted for 42 per cent of full-time graduate students but as much as 52.4 per cent of the part-time student body. The same table indicates also that increases in the participation of women in post-graduate education in Australia have been greater among part-time than among full-time graduate students: between 1978 and 1983 the percentage of women entrants enrolled on a full-time basis has grown from 28.5 per cent to 33.1 per cent, the percentage of part-time women entrants has increased by more than 11 per cent, from 27.2 to 38.3 per cent of all part-time post-graduate students. The trend is also similar in the United Kingdom, although there the differences appear smaller. It is interesting to note, however, that only a decade ago both in the United Kingdom and in Australia, the proportion of women was higher among full-time than among part-time graduate students and that these proportions have been reversed only in the 1980s. It remains to be seen whether such trends are going to continue. It appears, however, that women's part-time status might create additional difficulties for them.

Age of Post-graduate Students

Changes in the age of post-graduate students and of recipients of graduate degrees can result from a variety of different processes, social as well as institutional. On the one hand, the substitution of a short professionalised research training for the traditional long doctorate

Table 11. **Part-time and full-time women graduate students**

As percentage of:

	All new full-time and part-time entrants					
	1978		1980		1983	
	FT	PT	FT	PT	FT	PT
Australia	28.5	27.2	30.7	32.7	33.1	38.3

	All part-time and full-time post-graduate students							
	1975		1977		1980		1982	
	FT	PT	FT	PT	FT	PT	FT	PT
United Kingdom	26.4	23.1	27.8	25.9	30.7	29.5	31.4	31.9

	1975/76		1977/78		1980/81	
	FT	PT	FT	PT	FT	PT
United States	37.8	49.1	40.1	50.4	42	52.4

Source: Data supplied by national authorities.

should, as one of its consequences, bring about the lowering of the average age of the recipients of doctoral degrees. On the other hand, increases in the number of post-graduate students pursuing their training on a part-time basis, financial pressures, or other considerations, which lead prospective students to delay entry to post-graduate study (or even earlier, to the university) push average age up. So too do policies, such as those aimed at increasing the adult participation in post-graduate study or at improvement in the workforce. Moreover, increasingly, courses are being developed specifically geared to the needs and possibilities of students having some measure of work experience. Harvard (and a number of other major American business schools) now requires a minimum of two years of work experience for admission to its MBA programme. Thus, just as part-time study could be viewed as either problematic or challenging, so too here. Part of the explanation of student ageing is inherently problematic. But at the same time it is a reflection of changing views of the relations between work and higher education to which universities will necessarily have to respond. If, at a certain level of professional advancement, individuals in the non-academic sector (public or private) increasingly feel the value of some measure of further study, this is clearly a very different phenomenon from that of entry delayed through financial pressures. It has to be looked at differently from the concern in many countries that those newly graduating with PhDs enter the labour force at too advanced an age. In statistical terms, both phenomena show up in an ageing post-graduate student population.

In Finland, which retains the traditional long doctorate, the median age at the time of graduation was 35 in 1970/71 and remained unchanged at least until 1977/78. In Sweden, however, which introduced the four-year professional research training in 1969, the average age of research students rose from 33 in 1975 to 36 in 1983 (Table 12). A trend towards older post-graduate students can also be observed in Australia where, between 1978 and 1983, the percentage of post-graduate students in the 20-25 year-olds category declined from 25.6 to 20.2 per cent, while increases could be observed in all the older age groups (except for "50 and older"). Similarly, in the United States the median age of doctoral degree recipients rose from

Table 12. **Sweden: Average age of research students**

Faculty	1975	1977	1980	1983
Theology	37.5	38.2	38.6	40
Law	35.8	36.1	36.2	37
Medicine	34.1	34.4	35.0	36
Dentistry	34.4	34.5	35.5	36
Arts	36.2	37.6	39.9	36
Social sciences	32.3	33.6	35.9	41
Natural sciences	31.3	31.7	32.6	37
Technology	31.0	31.5	32.5	33
Forestry	35.7	33.7	33.6	32
Veterinary medicine	32.0	33.8	34.2	34
Agriculture	34.7	34.6	34.9	35
Pharmacy	29.5	29.7	30.4	31
Stockholm School of Economics	30.1	30.3	32.5	33
All faculties	33.0	33.8	35.3	36

Source: Data supplied by UHA, Stockholm.

31.6 in 1975/76 to 32.4 in 1980/81 (Table 13). In Norway, as well, the number of students who are 30 years or older has increased considerably since the beginning of the seventies.

Increases in the age of graduate students and degree recipients are not equally distributed among the different disciplines and it is interesting to note that also here one can observe similarities between different countries: students of the natural sciences and engineering tend to be younger and complete their degrees at an earlier age than students of the social sciences and humanities. While during the last decade there have been only small changes in the age of students in the natural sciences and engineering, the age of post-graduate students in the humanities and social sciences has increased in the three countries for which such data are available. Between 1975 and 1980, the average age of Swedish research students in the arts and humanities rose from 36.2 to 39.9, while the increase in the natural sciences has been much smaller: from 21.3 to 32.6. In Finland, the median age of doctoral degree recipients in the natural sciences actually declined from 35 to 34, while in the humanities it rose from 37 to 38. Similarly in the United States, the median age of doctoral

Table 13. **United States: Median age at the time of doctorate**

	1975/76	1976/77	1980/81
Education	36.5	36.5	37.3
Engineering	30.2	30.0	30.5
Humanities	32.5	32.6	33.5
Life sciences	29.9	30.0	30.1
Mathematics	29.1	29.1	29.2
Physical sciences	29.0	29.2	29.0
Professional fields	33.7	33.9	34.2
Social sciences	30.7	30.9	32.0
All fields	31.6	31.6	32.4

Source: Compiled from *Digest of Education Statistics* (various years).

degree recipients has remained stable in the physical sciences (approximately 29), mathematics (29.2), life sciences (30.1) and engineering (30.5), while rising in the humanities (from 32.5 in 1975/76 to 33.5 in 1980/81), social sciences (from 30.7 in 1975/75 to 32 in 1980/81) and education (from 36.5 in 1975/76 to 37.3 in 1980/81). The similarity of those trends in three countries with very different modes of organisation and financing of post-graduate education defies any simple explanation; but difficulties with the financing of post-graduate studies in the social sciences and humanities and the lack of motivation to complete training when prospects for professional and especially academic employment are not very encouraging, might be among the reasons why it is precisely in those fields that the graduate student population has been becoming older.

Foreign Students

Post-graduate training is the most internationalised segment of education, but the extent to which this is true varies considerably among the Member countries. There are also large policy differences on this issue and the participation of foreign students in post-graduate education is a matter of some controversy within several educational communities.

While research training in some countries involves large numbers of foreign students, other countries appear to be not receivers but senders of post-graduate students. However, this report will focus exclusively on the different rates of participation of foreign students in the post-graduate training in several Member countries and on policy differences with respect to this issue.

Obviously, since the rates of participation of foreign students vary greatly among the Member countries, the issue does not have the same policy significance in, for example, Finland as it does in Great Britain or the United States. While in Great Britain, the United States and Australia foreign students constitute a significant proportion of all post-graduate students, in Finland, to use the same example, the number of foreign students is exceedingly small (in 1979/80, there were 171 foreign post-graduate students out of some five and a half thousand Finnish students enrolled in post-graduate courses).

The overall proportion of foreign graduate students appears to be highest in Great Britain where in 1982/83 overseas students accounted for as much as 35 per cent of all students at post-graduate levels in the universities. This very high figure, however, represents a decline of more than 3 percentage points when compared with the 1977/78 proportions. In the United States and Australia, on the other hand, the proportion of foreign graduate students, though measured differently, has been increasing slowly. In the United States, the percentage of doctorates awarded to non-resident aliens rose from 15.2 per cent in 1975/76 to 16.6 per cent in 1980/81 (Table 14). In Australia, the percentage of foreign students enrolled in post-graduate education grew from 9.5 per cent in 1976 to 10.7 per cent in 1983. The number of foreign post-graduate students enrolled in Japanese universities is also growing though, when compared to the United States or Great Britain (Table 15), it is still rather small both in terms of numbers and in terms of percentages. In Germany, on the other hand, the number of foreign students passing doctoral examinations has remained stable at about 900 students per year. In view of the steady expansion of post-graduate studies in Germany this represents a percentage decline from 7.99 per cent of doctoral degrees in Germany awarded to foreign students in 1975 to 6.9 per cent in 1982.

What has caused particular concern in the United States, however, is the domination of certain fields by foreign students: much of the increases in the proportion of foreign graduate students has been due to increases in engineering where foreign students account for as much

Table 14. **United States: Foreign students receiving doctoral degrees**

Percentage

	1975/76	1976/77	1980/81
Arts and humanities	8.6	8.2	10.2
Education	5.9	6.5	8.8
Engineering	42.4	41.6	49.1
Life sciences	18.7	18.9	17.1
Mathematics	23.7	23.4	31.5
Physical sciences	22.2	21.1	21.3
Professional fields	15.3	17.2	16.6
Social sciences	12	11.8	11.9
Total	15.2	15.2	16.6

Source: Compiled from *Digest of Education Statistics*, various years.

Table 15. **Enrolment of foreign students in post-graduate education**

Percentage

	1976	1980	1983
Australia			
PhD and doctorate	14.7	14.6	15.6
Master's research	7.8	8.1	9.1
Master's coursework	6.8	7.5	8.1
Total	9.5	9.8	10.7
	1977/78	1980/81	1982/83
Great Britain			
Universities	38.6	34.7	35.0
Other	10.9	10.4	10.9
	1975	1979	1983
Japan (numbers)			
Total	(2 255)	(2 397)	(3 861)

Source: Data supplied by national authorities.

as half of all doctoral degree recipients. It appears that the viability of certain fields of graduate education is maintained to a great extent by foreign enrolments.

Although educators and policy-makers generally agree that some participation of foreign students in research training is desirable, there is no agreement on what is an appropriate proportion and how, if at all, this should be regulated. The increasing number of foreign post-graduate students is a cause of much concern in the United States. The National Commission on Student Financial Assistance claims that:

> "One result of the withdrawal of young Americans from the rigors of graduate study is the increasing proportion of foreign students in graduate programs. (...) This situation should occasion no surprise. Foreign students support graduate enrolment and, ultimately, compete for vacant teaching positions.

> Although there are understandable reasons for the increased incidence of foreign students in graduate schools, all of us must view this development with concern. The issue goes beyond the inability of foreign nationals to obtain security clearances needed for research in sensitive areas. Marvin Goldberger of the California Institute of Technology rhetorically underscored the longer-term implications of this trend when he told the Commission: "If we continue on our present course, we are going to have all foreign students taught by ... foreign faculty, because they are the only ones who have PhDs"[7].

Attitudes of policy-makers towards the participation of foreign students seem to be quite different in France where the recent restructuring of post-graduate education has been in part designed to make the French system of earning graduate degrees more comparable to systems used elsewhere, and especially to the American PhD. One of the arguments used in proposing the changes was that the reorganisation would facilitate the participation of foreign graduate students:

> "The reform of post-graduate studies, planned under the Bill on higher education, is meant to simplify and update our doctoral system, while, and at the same time, conform it more to the main systems of higher education abroad.
> (...) From an international point of view, the level of this doctorate will be the same as in other countries, and especially at the PhD level. It will also be easier to allow foreign young researchers to study in France in order to obtain a degree that is internationally recognised."[8]

Such very different attitudes towards the participation of foreign students reflect not only the very different rates of participation of foreign students in post-graduate studies in the countries involved, but also different calculations of costs and benefits flowing from their presence. It appears that in the United States, benefits – in the form of international contacts and tuitions paid to the universities by foreigners – seem, in the eyes of certain policy-makers, to be outweighed by costs, whether these are calculated in terms of financing the education of foreigners or take the form of competition in the labour market by those recipients of graduate degrees who choose to remain in the United States, and the apparent dominance of foreign students in areas of learning felt to be of particular national importance. Such calculations must be very different in France where the wish to attract foreign students remains a policy goal despite the fact that they pay no tuition and their attendance does not serve as a source of additional revenue for the universities.

Chapter 4

THE FINANCE OF POST-GRADUATE STUDY

In the majority of Member countries for which information is available, students finance post-graduate study and research in a complex variety of ways, ranging from part-time employment wholly outside the university, through support from parents or wives/husbands, to support by means of a fellowship intended specifically for training of new researchers. In countries with large, long-established and highly-developed systems of post-graduate education (such as France, the United Kingdom or the United States) this internal complexity is very great, as will appear later in this chapter. But despite this internal complexity, it is also possible to make some comparison between countries on the basis of the existence/non-existence of a central fellowship scheme for post-graduate support, and the scale and administration of any such scheme. That is to say, in a number of Member countries there are support schemes – such as the Post-graduate Awards of the British Research Councils, the Commonwealth's Post-graduate Award scheme (CPAS) in Australia, the *Allocations de recherche* of the French Ministry of Industry and Research – which exist for the purpose of supporting the training in research of a significant number of post-graduate students. The number, value, and distribution between disciplines (and perhaps universities) of these fellowships are central instruments of policy towards post-graduate education: other than the framing of regulations and control of capital investment, it is perhaps the major means available to central authorities for implementing any such "post-graduate education policy". This includes, of course, the framing of manpower requirements with regard to research scientists and the attempt to bring training into line with such requirements. In certain other countries the situation is totally different. In countries such as the Netherlands and Norway, in which the preparation of a doctoral thesis has not traditionally been a *student* activity, schemes of this sort do not exist. Research training has tended to be financed either from university *employment*, or on the basis of a research proposal submitted to a Research Council by an established scientist, and judged in scientific terms.

Whilst the trend towards professionalisation of post-graduate training (which will be discussed in Chapter 8) tends to have as one of its elements the introduction of a specific scheme of post-graduate support – so that there is, as it were, a gradual shift towards the first of these two structures – there are at present clear differences in this respect. The discussion in this chapter, therefore, divides into two parts. In the first part these overall pictures are contrasted. In the second, the focus is upon current policy towards fellowship schemes, where these exist. As suggested above it is here that "post-graduate education policy" finds its clearest exemplification.

Overall Patterns of Support: The Changing Picture

Japan, the United States, the United Kingdom and Sweden are examples of countries with professionalised post-graduate training, though with very different patterns of support.

Since it has not been possible to put data on to comparable bases, they are shown separately for each of these countries in Tables 16-20. Japanese data suggest a small decline in the extent of support from scholarship schemes, and a corresponding growth in support from parents. Parental support now seems to provide for over 40 per cent of Japanese post-graduate students. This is a very different pattern from that shown by other countries.

Table 16. **Japan: Percentage distribution of educational expenditure of post-graduate students by sources of income**

Sources of support	1976		1982	
	Yearly amount in Yen	Per cent	Yearly amount in Yen	Per cent
Payment by parents	342 800	37.2	585 700	41.8
Scholarships	288 500	31.3	411 400	29.3
Income from part-time job	232 000	25.2	341 100	24.3
Income from full-time job or others	57 500	6.2	64 100	4.6
Total	921 000	100.0	1 402 300	100.0

Source: Ministry of Education, Science and Culture. *Report on Students' Living*; and data supplied by Japanese authorities.

The situation in the United States is rather complex, due to the considerable variety of federal schemes providing for support of graduate study and research. Table 17 shows roughly 25 per cent supported from federal government funds – a figure which has not changed much in the course of the last years – 35-40 per cent supported by academic institutions themselves (for example as teaching assistants), and a slightly smaller percentage supporting themselves. The category "other" includes notably industrial support. This apparently constant level of federal support (but for full-time students in science and engineering only) in fact conceals two contrary trends. On the one hand, there has been a continuing fall in the availability of fellowships financed by the research agencies of the federal government. More or less balancing this, however, has been an increase in the number of research assistantships available in federally-financed research projects. Federal support of this kind is largely concentrated in the natural sciences, biomedical sciences and technology/engineering. Private foundations, which have had a more significant role in other areas of study have also contracted. Whereas in 1972 private foundations provided fellowship support for some 5.3 per cent of doctoral students, in 1981 this had declined to less than 3 per cent. Industry has taken up little of the slack. "Although corporate involvement in graduate education is growing and is having a salutary effect on shortages in engineering, testimony from corporate representatives makes clear that they see only a limited role for corporations in supporting graduate education". The decline in federal fellowships has been made up in a number of ways: through growing institutional and state support, through borrowing, and through self-support. Although borrowing is not generally the principal source of support, a growing proportion of students finance their graduate study partly through this means (12 per cent in 1972, 25 per cent in 1982). Self-support (work, support of parents and spouse) is also of growing importance – and in this respect the figures of Table 17, which are limited to science and engineering, are unlikely to be typical of the whole range of disciplines. There is evidence that in 1980/81, of all graduate students, over half supported themselves (or were supported by their families).

Table 17. **United States: Sources of support of full-time students in science and engineering**

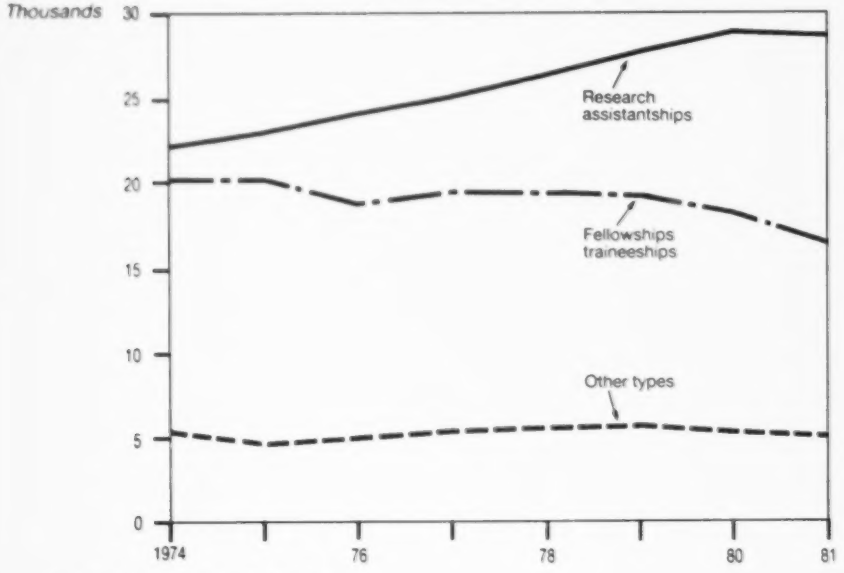
Percentage

	1975	1977	1981
Federal agencies	23	23	22
Institutions	37	37	39
Self	32	32	30
Other	8	8	9

Source: Compiled from *Science Indicators 1982*, Appendix Tables 5-19.

Figure 2

FULL-TIME SCIENCE AND ENGINEERING GRADUATE STUDENTS IN DOCTORATE-GRANTING INSTITUTIONS BY TYPE OF FEDERAL SUPPORT: 1974-81



Source: *Science Indicators 1982*, Figure 5-14.

In the United Kingdom, too, the major governmental schemes of fellowship support, operated by the various Research Councils, are largely limited to the natural and biomedical sciences, technology and the social sciences. Data for British students (i.e. excluding the large proportion of foreign students) in universities (excluding polytechnics and other colleges) in the fields for which three of the Research Councils are responsible (natural science and engineering, social science, and environmental science) are given in Table 18. It is clear that in these fields the Research Councils were the principal supporters of post-graduate education of

Table 18. **United Kingdom: Sources of support for scientific post-graduates in universities (home students only) 1974-1975 and 1979-1980**

Science and Technology by Subject Group

	31 December 1974				31 December 1979			
	Eng/Tech.	Sci.	Soc. Admin. & Bus. Stud.	Total	Eng/ Tech.	Sci.	Soc. Admin. & Bus. Stud.	Total
Research Councils	1 935	5 314	2 394	9 643	1 795	5 645	2 203	9 643
%	(60)	(69)	(37)	(56)	(66)	(76)	(35)	(59)
UK Government Departments, etc.	225	319	1 320	1 894	205	282	1 826	2 313
%	(8)	(4)	(20)	(11)	(8)	(4)	(29)	(14)
No award	392	627	1 093	2 112	293	466	837	1 596
%	(12)	(8)	(17)	(12)	(11)	(6)	(13)	(10)
Local government	84	106	698	888	57	89	677	823
%	(3)	(1)	(11)	(5)	(2)	(1)	(11)	(5)
UK University	123	524	209	856	114	434	221	769
%	(4)	(7)	(3)	(5)	(4)	(6)	(4)	(5)
Industry	200	216	110	526	151	194	79	424
%	(6)	(3)	(2)	(3)	(6)	(3)	(1)	(3)
Charities	19	116	23	158	9	69	23	101
%	(1)	(2)	(0)	(1)	(0)	(1)	(0)	(1)
Others and not known	173	479	609	1 261	94	207	371	672
%	(5)	(6)	(9)	(7)	(3)	(3)	(6)	(4)
Total	3 181	7 701	6 456	17 338	2 718	7 386	6 237	16 341

Source: Advisory Board for the Research Councils *Report of the Working Party on Post-Graduate Education* (HMSO, London 1982), Table 2.1.

"home" students and that – in science and engineering, though not in social science – their contribution has been rising. However, the picture is very different if all students in all disciplines are considered. On this basis, the Research Councils between them appeared to support some 23 per cent of students in 1980 and 22 per cent in 1982, with government departments contributing a further 5 per cent. Self-support is of the order of 20 per cent.

Swedish data, given in Tables 19 and 20, show a very different picture. The extent to which post-graduate study in Sweden is pursued on a part-time basis has already been mentioned. This becomes still clearer from these data. Nearly half of all Swedish post-graduate students finance their studies by means of a part-time post (or a full-time post) held outside the university. The figure has changed little over the past five years. A further 30 per cent have typically held teaching posts or teaching assistantships within the university. Looking at the natural sciences alone yields a somewhat different picture, with fewer students occupied outside the university (32-34 per cent) and very many more occupying teaching assistant or other teaching posts inside (38-39 per cent). Relatively few students (even in the natural sciences) are supported from research project funds. As Table 20 indicates those who receive some type of university funding during their research training are far more likely to complete their degrees.

In countries where post-graduate education is an informal matter, involving less "training" than the preparation of a thesis in the course of scientific and educational work,

Table 19. **Sweden: Percentage of active research students who financed their studies from different kinds of sources as reported for spring terms 1976, 1978 and 1981**

Faculty	Fellowships (a different type as from 1976)			Research assistants (financed from project funds)			Teaching assistantships			Other teaching posts in the university			Posts outside the university		
	1976	1978	1981	1976	1978	1981	1976	1978	1981	1976	1978	1981	1976	1978	1981
Theology	16	9	7	-	1	-	9	7	8	7	6	7	49	42	61
Law	23	11	12	-	1	1	5	3	3	19	21	19	38	33	39
Medicine	7	7	7	1	2	1	24	22	21	2	2	2	67	66	68
Dentistry	10	4	9	-	1	2	51	47	52	23	19	20	42	50	34
Arts	14	13	15	1	3	2	9	9	9	9	8	9	43	47	47
Social sciences	9	11	13	2	7	7	13	14	13	12	13	17	44	44	41
Natural sciences	15	13	17	6	8	10	33	33	35	5	5	4	34	34	32
Technology	7	6	8	7	12	13	43	38	35	6	5	6	42	42	44
Forestry	1	7	6	7	5	16	43	37	34	13	8	9	46	33	33
Veterinary medicine	12	6	7	6	11	11	47	39	32	18	10	8	27	25	33
Agriculture	10	6	9	3	9	18	27	33	22	6	5	6	57	50	43
Pharmacy	12	5	16	6	5	5	35	38	40	6	3	3	44	45	45
Stockholm School of Economics	12	20	13	-	-	28	14	17	4	15	17	19	59	74	55
All faculties	11	10	12	3	6	7	23	22	22	8	7	8	45	45	46

Note: More than one type of source was reported for about 8 per cent of the students, no source at all for 10-25 per cent.
Source: Data supplied by UHA, Stockholm.

Table 20. **Sweden: Proportion of graduates until 1982 (Spring) among beginners in research training 1972/73 with/without university funding**[1]

Faculty	With some type of university funding[1]			Without university funding		
	Total number of beginners	Number of graduates	Percentage	Total number of beginners	Number of graduates	Percentage
Arts	199	45	23	264	13	5
Social sciences	274	59	22	227	12	5
Mathematics and natural sciences	312	144	46	88	21	24
Medicine	182	115	63	100	46	46
Technology	257	92	36	119	19	16
All faculties	1 356	511	38	854	119	14

1. Fellowships or research or teaching assistantships or other teaching posts within the university.
Source: Data supplied by UHA, Stockholm.

statistics on financial support are more or less non-existent. Many, perhaps the majority, of those who are preparing their doctoral theses in the Netherlands are members of the staff of the universities, with duties in teaching and research. They have the status of faculty, not student, and many of them either have permanent (tenured) appointments, or can expect to get their tenure after a three- or four-year probation period. In addition there exist the so-called "doorstromers" (literally, those "flowing through" the university), hired on a temporary basis in order to write a dissertation. *Doorstromers* are often financed by Research Council (ZWO) funds, on the basis of a proposal made by the head (usually professor) of the research group in which they will work. It is the proposal which is judged, on its scientific merits, for support. Even though funds of this kind are available in all fields, doorstromers are concentrated to a large degree in the natural sciences. A recent study of three faculties (arts, natural science, social science) in each of six Dutch universities, showed that 12 per cent of doorstromers were in the social science faculties, 10 per cent in the arts faculties, and 78 per cent in the natural science faculties[9]. Proposals currently under discussion in the Netherlands move very much more in the direction of practice abroad. These proposals, which introduce the concept of "assistant-in-training", can only be understood in relation to the broader question of the professionalisation of research training in the Netherlands, and are taken up again in Chapter 8. In Norway, there are differences between the pattern of support for post-graduate studies at different levels. Those preparing a doctorate are supported mainly from their employment at the universities, and the Ministry of Cultural and Scientific Affairs presupposes that their studies should be adjusted to the existing resources of institutions and not separately financed as doctoral studies. On the other hand, those working towards the intermediate degrees do receive separate government support in the form of grants and loans. Loans constitute approximately 80 per cent of the total support. The rising expenditure on student aid has been of concern to the government since the end of the seventies and the real value of student loans and grants has declined since then.

Clearly it is difficult to summarise so complex a picture as these various national systems together compose. What is apparent is that in none of these countries – and the same is almost certainly true for almost all other OECD countries – does the possibility of strict manpower planning through control of finance of study exist. Either support of post-graduate study is almost invisible (as when no such educational cycle exists, or when support is mainly from

other employment), or where fellowship schemes do exist these support only a minority of students. The only apparent exception is science and technology in the United Kingdom, at least if non-British students are excluded. Even though many of these schemes have declined in scale, supporting fewer students, there have generally been possibilities to find other sources of finance. Though strict manpower planning would seem impossible, this does not, however, mean that funding bodies (Ministries, Research Councils) operating such schemes have not sought to use them as the basis for policies of one kind or another. We shall now deal with the development of policy towards post-graduate education as reflected in the allocation of student support.

Student Support Policies

In describing developments in policy towards post-graduate student support in some Member countries, a number of general tendencies can be derived. In the United Kingdom, schemes are operated by each of the five Research Councils. The number of new awards made yearly over the past decade shows a sharp decline since 1977/78 in support for post-graduate training in the environmental and earth sciences, and a pronounced growth since 1980/81 in the fields of natural science and engineering. This shift towards the natural and engineering sciences is expected to continue. Within each of the Councils, practice is to determine each year the distribution of awards between the main groups of disciplines for which each Council is responsible: each science field receives its allocation. In fact, the planned increase in the number of new awards for the support of post-graduate students is mainly due to an increase in the number of awards made available specifically for research and study in the field of information technology. In the biomedical field, too, policy provides for increases in support carefully tailored to priority fields. Thus the Medical Research Council plans to double the number of awards in the field of recombinant DNA technology research, and for advanced study in fields related to the operation of the health services.

Post-graduate student support policy thus consists principally in planning the overall numbers of awards to be made available and their distribution between fields of science, on the basis of assessments of manpower priorities. A recent policy report on Post-graduate Education (produced by a Committee under the chairmanship of the Vice-Chancellor of Cambridge University) sought to broaden the discussion. The report dealt with the *level* of support – where they backed off from recommending a major increase in the value of the studentship because they recognised that this would be achieved only at the expense of other scientific activities or the number of awards. A loan scheme was also rejected[5].

> "What we would like to see, however, is a good deal more flexibility introduced into the way the award scheme operates. On the one hand we would like to see Councils allowed to pay in exceptional circumstances above the agreed normal level of award – as they can already do for awards connected with a Teaching Company, and as the Manpower Services Commission can already do for all of its awards. Since Research Councils are already cash-limited, we see no reason to retain other constraints on their freedom to award. For the same reason, we think that Councils should be free to agree the normal level of a postgraduate award – which would of course have to be the same for all Councils.
>
> On the other hand, we would like to see Councils make more use of "fees-only" awards. The most obvious case we have in mind is that of post-experience candidates for a course in business management. In some cases the employer will be willing to pay the candidate's maintenance costs – and even if not, the candidate should be willing to

borrow money since he is taking the course in order to increase his earning power – but there is a stronger reluctance to pay fees. If "fees-only" awards were allowed, the limited amount of money which the SSRC can spare to support business management courses could be spread much more widely."

The proposal to provide partial support is now being tried out on an experimental basis by the Economic and Social Research Council (previously SSRC) in the field of management studies.

In Australia the Commonwealth Post-graduate Award Scheme (CPAS) has been operated on a quite different basis, and does not provide for the same kind of "manpower planning" as the British Research Councils attempt. The procedure here is that the number of awards available is distributed between the various universities on the basis of their record in attracting post-graduate students, in terms of both number and quality (Table 21). According to a recent study by Professors Hill, Johnston and Smith "this produces an essentially

Table 21. **Australia: Commonwealth post-graduate awards 1959-1983**
Number and value of awards, number in training and proportion of scholars

Year	Value of award in $ [1]	Total No of new awards [2]	Total No of awards [2]	Research		Course		Research scholars as a proportion of all enrolled research students	Post-graduate award scholars as a proportion of H/D students
				New	In training	New	In training		
1959	1 400	100	100	100	100			4.5%	4.5%
1960	1 400	100	173	100	100			6.2	6.2
1961	1 400	100	217	100	217			6.8	6.8
1962	1 600	125	266	125	266			7.0	7.0
1963	1 600	225	340	225	340			7.0	7.0
1964	1 800	225	469	225	469			8.7	8.7
1965	1 800	300	634	300	634			10.3	10.3
1966	1 800	400	874	400	874			11.6	11.6
1967	1 800	500	1 179	500	1 179			12.8	12.8
1968	1 800	500	1 372	500	1 372			14.9	14.9
1969	2 350	650	1 629	650	1 629			15.5	15.5
1970	2 350	650	1 730	650	1 730			19.4	15.0
1971	2 600	800	1 955	700	1 571	100	98	19.2	15.7
1972	2 600	800	2 055	700	1 930	100	125	19.7	15.8
1973	2 900	800	2 055	700	1 931	100	124	19.6	14.9
1974	3 050	875	2 129	725	1 953	150	176	19.4	14.0
1975	3 250	875	2 191	725	2 006	150	185	18.8	13.2
1976	3 250	875	2 183	725	2 001	150	182	18.1	12.4
1977	4 000	780	2 201	635	2 006	145	195	17.5	12.0
1978	4 200	680	2 022	555	1 840	125	182	15.7	10.6
1979	4 200	680	1 881	555	1 717	125	164	14.3	9.5
1980	4 200	680	1 816	555	1 652	125	164	13.5	8.8
1981	4 620	775	1 831	635	1 665	140	166	13.4	8.4
1982	4 620	753	1 984	635	1 798	140	186	13.9	8.5
1983	6 850	900	–	735	–	165	–	–	–

1. Value converted to $ for years prior to 1966.
2. CAE awards have been excluded.

Sources:
AVCC, Table 3, p. 13, unpublished, submission to the Department of Education, "Review of Need for Postgraduate Awards, 1980".
CAPA submission Table 6, p. 174, "Postgraduate Finance", a submission to the AVCC Inquiry into Student Finance, September 1982.
Figures for 1978 and 1982 from Australian Bureau of Statistics "University Statistics Master Tables", Table 1A for each year.

conservative system, determined by past performance, and, in this form, with little capability of responding to rapidly changing pressures or needs"[10]. The second stage involves the allocation to individual students by each university. This is done principally according to class or degree at the undergraduate level. The result is a fluctuating number of new awards, though supporting a declining share of research students, and a pattern of remarkable stability between disciplines. Although discipline is not a factor which enters into allocation of awards in any systematic fashion, the natural and applied sciences have received a more or less constant 50 per cent of the total awards made, year after year. In their report, Professors Hill, Johnston and Smith argue that the merit of an individual student is no longer to be taken as the single criterion in the allocation of awards. Separate schemes for social sciences and humanities on the one hand, and natural and applied sciences on the other should be introduced, so that allocation could take account of differences in criteria which might be relevant in each case. Moreover, they argue that the allocation of studentships should to a greater degree take account of strengths in *research* of different university departments, so that numbers of awards should be allocated to individual departments on the basis of an assessment of each department's strength in research: somewhat analogously to the practice of the British Science and Engineering Research Council.

In Sweden, recent developments in the finance of post-graduate studies have had two particular thrusts. The first has involved making more visible that element in student support associated with research training. Recent reforms have led to the abolition of the junior teacher appointments which used to represent a combination of departmental duties and private study/research. Post-graduate student benefits now take the form of a grant. These grants, awarded by individual universities, can however be combined with a part-time appointment which is *entirely* devoted to departmental duties. The second thrust has been towards special support in priority fields of science and technology. A major concern within Swedish science and higher education policy is the possible shortage of research-trained manpower in certain fields of industrial and social relevance. A new type of award, the doctoral studentship, has been introduced precisely within fields identified in this way. Involving no duties beyond post-graduate studies, these appointments are intended to recruit highly-qualified students to research training in such fields. These awards are highly beneficial to their holders, not only because the level of remuneration is higher than with a grant but also because, unlike grants, they are combined with all the social benefits associated with tenure of an appointment. However, because the total cost of such a studentship to a university actually works out at approximately twice that of a student grant, relatively few have been established by the universities themselves. Some hundred have been established at the central level by the Research Councils. Whilst the whole question of student support schemes at the post-graduate level is currently under review, there is general consensus that no additional funds are likely to be forthcoming. There is thus some discussion of the benefits and drawbacks of further extension of the more expensive studentship scheme: this would clearly lead to a decrease in the total number of students who could be supported. (On the other hand, within the Swedish debate, this is accompanied by a view held by, *inter alia*, the National Audit Bureau, that the total scale of post-graduate training should in fact be reduced).

In France, the principal system of subsidisation of student research training is the scheme of *allocations de recherche* operated by the Ministry of Research and Technology. Each year, a quota of awards is allocated to a particular department or formation – typically between 1 and 10 – which the department then grants to chosen students preparing their *doctorat de troisième cycle*. Hitherto, 1 600 of these awards have been made available each year, each award lasting for a period of two years. The distribution of awards available in September 1983, between fields of science, was:

Physics	152	Civil engineering, etc.	105
Mathematics	69	Natural environment	152
Electronics, etc.	230	Life sciences	373
Chemistry	183	Social sciences	159
Materials	86	Human sciences	57
Physical chemistry	34		

Within the framework of a radical revision of the organisation and structure of qualifications within post-graduate education which has just been introduced in France (see below) this scheme is to be extended. At present, the government plans to increase the number of awards available under the *allocations de recherche* from 1 600 to 1 900. It is also hoped to increase the duration of an award from the present two years to three years (except in certain cases). However these two desiderations, taken together with pressure to increase the monthly level of the award, are leading to uncertainty over the financing of the new scheme. It may be that one at least of these planned changes will be dropped.

The increasing *visibility* of post-graduate education, and particularly research training, as a policy issue in its own right, is manifest in the developments described above. In various Member countries' studies, committee reports, and policy initiatives have been addressed to the question of finance of post-graduate research training, reflecting its significance as a means for the implementation of policy. In most instances formal research training support schemes have provided for a declining proportion of the total number of students carrying out post-graduate research. This is in line with the general decline in funds for university research which took place through the 1970s. Accompanying this greater concern with post-graduate research training is an attempt to make the dimensions and the nature of the situation clearer. This is reflected not only in calls in some countries (e.g. Finland) for better statistics, but also in the change in the funding mechanisms employed (for example in Sweden). But most striking of all is perhaps the selective expansion which is now taking place. What the recent developments in the United Kingdom show most clearly, but is no less true in many other Member countries, is the selective targeting of *new* funds for training researchers upon areas of science and technology identified as of priority importance with science and technology policy (information sciences, biotechnology, etc.). In cases where overall resources are limited – that is to say, are being held down – such as Sweden or the United Kingdom, this is likely to be taking place at the expense of research training in fields seen as "posteriorities". But since the formal support schemes operated by government agencies (usually for science and technology) rarely support more than a relatively small share of all research students, the extent to which this kind of manpower planning can be extended is necessarily limited.

Chapter 5

INSTITUTIONAL LOCATION

Concentration of Post-graduate Education

Given the emphasis of educational policies on productivity and efficiency, as well as the fact that the second half of the seventies and the early eighties saw only a modest rate of growth or actual declines in post-graduate education in a number of Member countries, it would be reasonable to expect a concentration of this education in a smaller number of institutions. Such a concentration could be further encouraged by patterns of financial support both in the form of direct support for post-graduate students and, more generally, in support for research. In times of financial pressure, funds could be expected to be directed preferentially to larger and more established institutions. In Great Britain, there has been an explicit policy recommendation aimed at directing the allocation of funds to larger institutions and thus encouraging concentration of post-graduate studies in a smaller number of institutions:

> "There are some readily apparent ways in which students in small departments may be disadvantaged as against those in larger departments though the consequences may be less serious in the social than in the experimental sciences. First they do not have the benefit of mixing with many other students involved in broadly the same discipline; contact of this nature is useful in maintaining morale as well as assisting in the education of students. Second, students in small departments are less likely to have easy access to the same range and quality of equipment as those in larger ones, or to that steady flow of ideas which comes from mixing with staff in large teaching departments. (...) For these reasons we think that as a general principle, unless there are particular reasons to the contrary, the larger departments are likely to provide a richer environment for research students than those too small to give full facilities. This is an aspect we consider Research Councils should take into account in their selective approach to the allocation of quotas."[11]

Despite such pressures in the direction of greater concentration of post-graduate education in a smaller number of universities, it is noteworthy that in no Member country for which data are available (with the possible exception of France) can such concentration yet be observed.

In Sweden, which experienced a moderate growth in graduate enrolments, more institutions for research training were established as part of the university reform of 1977.

The number of universities granting graduate degrees, both master's and doctoral, has been increasing in Japan, which saw a modest rate of increase in the number of post-graduate students. In 1975 Japan had 213 universities granting post-graduate degrees, 131 of which

granted doctoral degrees. By 1980, the number of institutions granting graduate degrees had increased to 257, 169 of which granted PhDs. By 1983, 268 Japanese universities had graduate programmes and 179 granted doctoral degrees.

In Finland, where the number of institutions offering post-graduate training has remained stable, the proportion of degrees granted by the largest institution – the University of Helsinki – had actually declined from 48.5 per cent in the 1970/71-1974/75 period to 41.8 per cent for the academic years 1975/76-1979/80. There has also been no regional concentration: in the academic years 1970/71-1974/75, 82 per cent of all post-graduate degrees were awarded in the southern institutions of higher education in Helsinki and Turku. During the following five years, the share of post-graduate degrees granted by these institutions declined to 74 per cent.

Another country in which one cannot observe any concentration of graduate training is Australia, one of the few countries with a steady rate of growth in post-graduate enrolments. In 1975, the five largest Australian universities (Sydney, New South Wales, Melbourne, Monash and Queensland) accounted for 72.9 per cent of all graduate student enrolments. In 1983, the same five largest universities accommodated 58 per cent of the total post-graduate enrolment in Australia.

Despite the decline in the total number of doctoral degrees granted in the United States, there is no evidence of increased concentration of graduate studies in a smaller number of institutions. In 1981/82, there were 452 universities granting doctoral degrees, and additional 662 institutions offering some post-graduate education (Master's degree and beyond, but no PhD). The percentage of all PhDs granted by ten schools granting the highest number of degrees had declined from 21.9 per cent in 1971/72 to 17.5 per cent in 1980/81. Similar decline can be observed when one considers the first 25 and the first 61 universities granting the highest number of PhDs (Table 22).

If data from these countries can be considered representative, then, despite the predictions that the general contraction of graduate training in the late 1970s and early 1980s would result in a greater concentration of post-graduate studies, and despite the policy preferences expressed in certain countries to concentrate post-graduate training in a smaller number of "centres of excellence", the expected trend towards greater concentration of post-graduate training can not yet be observed. It is difficult, however, to ascertain whether this represents a failure of policies (or of will in the face of the *aspirations* of institutions,

Table 22. **United States: Concentration of doctoral study**

	1971/72	1975/76	1980/81
Number (and % of the total) of doctoral degrees granted in:			
10 schools granting the highest number of doctoral degrees	7 306 (21.9)	6 586 (19.3)	5 767 (17.5)
25 schools granting the highest number of doctoral degrees	14 136 (42.4)	13 046 (38.3)	11 659 (33.4)
61 schools granting the highest number of doctoral degrees	22 860 (68.5)	22 106 (64.9)	20 048 (60.8)
Total number of doctoral degrees granted	33 363 (100)	34 064 (100)	32 958 (100)

Source: Calculated from *Digest of Education Statistics 1983-84*, Table 116.

especially those newly established in the 1960s, to provide the highest possible levels of education), or whether there has indeed been no concerted policy pushing in this direction (despite the claims made for its desirability in some countries).

The Corporate Classroom

The United States case study on the *Role and Functions of Universities* refers to a phenomenon which appears not yet to have taken root in any other Member country, and which is referred to as "the corporate classroom". By this is meant the extension of higher education provision out of the traditional academic system. "Business and labour organisations", the report points out, "are developing their own systems for providing post-secondary education not only for skills development, but as a substitute for graduate or professional education as well".

> "Businesses are "competing" with colleges and universities for non-employee students as well. For example, in 1973 the Arthur D. Little Company was the first corporation in the United States granted state approval to award graduate degrees. The company's management institute awards a Master of Science in Management. Since 1970 the Rand Graduate Institute, organised by the Rand Corporation, has offered a doctorate in policy analysis. These graduate programmes are accredited and viewed by the business community as equivalent to university-based graduate programmes."

A beginning has been made for formal recognition and accreditation procedures for these non-university programmes. The American Council on Education, together with the State University of New York, has instituted a review procedure, and "To date, over 2 000 courses at 138 corporations have been identified by the ACE programme and have received credit-hour equivalency recommendations". Beyond this, the United States case study sees growing competition for universities and colleges from Trade Union education centres and those run by the armed services. There is as yet no indication that higher educational institutions elsewhere face competition of this kind. Yet, given the tremendous interest (on the part of students and of industry) in business and commerce-oriented professional programmes (see Table 3), as well as the efforts now going into seeking to innovate in university-industry relations, it would be surprising if the same challenge did not ultimately emerge elsewhere. Perhaps multinational corporations will be its carriers, for they indeed spend vast sums on employee training, and such developments may seem a logical extension and formalisation of the efforts they already make.

Chapter 6

THE DURATION OF RESEARCH TRAINING AND THE PROBLEM OF NON-COMPLETION

In most countries for which information is available, and which have a "professionalised" system of research training, the nominal duration of the training is 3-4 years. It is generally considered that the student should be able to acquire the necessary knowledge and skills, carry out his/her project, and write the results into an acceptable dissertation in 3-4 years of full-time study. Yet this norm bears little relation to reality. Relatively few students succeed in obtaining their doctorates within this period of time, and many *gradually* abandon their work and never complete their dissertation. Irrespective of country, the situation seems typically to be more serious in these respects in some fields than in others. The whole issue, and its causes, is a major one in current discussion of post-graduate education. In the attempt to come to grips with the problem, and to develop means of reducing what seems to be a growing problem of lengthening of studies or non-completion, research studies have been carried out in a number of Member countries.

There are a number of ways in which the problem may be expressed, and the data available are not strictly comparable. One aspect is the duration of studies and the effects of a long (or lengthening) training period upon the age at which the graduate is available to enter employment fully trained. In a number of countries, and particularly those with a very long (traditional) doctorate, there has been concern expressed at the fact that PhD-holders are often not available for employment until their mid- to late 30s – at which time, perhaps, their interests and commitments are more "set" than (at least non-academic) employers would like. Data for the United States are presented in Table 23. These confirm the view expressed in the report of the National Commission on Student Financial Assistance, that "the length of time taken to complete a degree has increased in all fields, especially in the humanities and the social sciences[7]. Data show that except in mathematics and engineering, life and physical sciences, there has been an increase in the age at which students receive their PhD. They also show that the number of years elapsing between receipt of the bachelor's and doctorate degree has similarly been increasing. However, what is not ascertainable from these figures is whether or not this increase is due to students taking time off from studies (perhaps postponing the beginning of graduate work).

Nor does this table take account of students who fail to complete. Data from the United Kingdom, which also leave aside students who fail to complete, also show that typical duration of doctoral study varies between disciplines and is significantly longer in the social sciences than in the physical sciences (Table 24).

Data for Sweden presented in Table 25 show comparable inter-disciplinary variations, and also show that, as in the United States, the time taken to complete doctoral training has been increasing through the 1970s, and – again – especially in the social sciences and the humanities.

Table 23. **United States: Median age at the time of doctorate and median time lapse from bachelor's to doctor's degree**

	1972-73	1975-76	1976-77	1980-81
All fields				
Age	31.3	31.6	31.6	32.4
Time lapse	8.4	8.6	8.7	9.4
Education				
Age	36.5	32.5	36.5	37.3
Time lapse	9.2	12.6	12.5	13.5
Engineering				
Age	30.4	30.2	30.0	30.5
Time lapse	7.7	7.5	7.5	7.9
Humanities				
Age	32.0	32.5	32.6	33.5
Time lapse	9.2	9.7	9.9	10.8
Life sciences				
Age	30.1	29.9	30.0	30.1
Time lapse	7.2	7.3	7.2	7.3
Mathematics				
Age	29.1	29.1	29.1	29.2
Time lapse	6.8	6.9	6.9	6.9
Physical sciences				
Age	29.1	29.0	29.2	29.0
Time lapse	6.7	6.7	6.9	6.7
Professional fields				
Age	33.2	33.7	33.9	34.2
Time lapse	10.0	10.6	10.7	11.1
Social sciences				
Age	30.5	30.7	30.9	32.0
Time lapse	7.7	7.8	8.0	9.0

Source: Digest of Educational Statistics 1983-84

Systematic data on non-completion – the extent to which students beginning doctoral training eventually fail successfully to write their thesis – are scanty. Statistically, where no upper limit (maximum time period within which a dissertation must be presented) exists, there is of course no strict definition of "non-completion" possible. One can only define, arbitrarily, some period of time and refer to the proportion of students who have failed to complete within that period. Table 26 does this for PhD students from Cambridge University, one of the most selective in the United Kingdom. The clear difference between the physical and the social sciences and humanities, suggested by duration data from which non-completers were excluded, is borne out here. Thus, whereas 91.3 per cent of students in physics/chemistry and 88 per cent of students in engineering have completed in 8 years, this is true of only 57.8 per cent in English and less than 50 per cent in social sciences. The problem of non-completion in Sweden appears to be more acute than these figures from one British university. If the same 8 year cut-off point is taken, then it is apparent that the proportion of entering graduate students who obtain their PhDs within this period varies from ± 30 per cent in the natural sciences to ± 10 per cent in the arts and social sciences (Table 27).

Since data are available for relatively few Member countries the scope for generalisation is clearly limited. Nevertheless, on the basis of what is available, it does seem reasonable to believe that in a number of countries: *a)* there is a major problem of non-completion and an

Table 24. **United Kingdom: Time taken to complete all theses submitted in 1978-79**

Time taken	English	Physical science	Biological science	Social science	Total
Up to 3 years	32	23	36	19	29
3 to 4 years	32	49	37	23	37
4 to 5 years	26	25	23	46	27
Over 6 years	10	3	4	12	7
	100	100	100	100	100

These figures of course take no account of students who never completed.
Source: ABRC Report (note 5), Table 3.3.

Table 25. **Sweden: Length of study for degree in research training**

(Median number of terms from matriculation as a research student to doctorate)

Faculty	1975-76	1977-78	1980-81
Theology	10.0	14.5	13.0
Law	11.0	17.5	13.0
Medicine	9.0	10.0	12.0
Dentistry	11.0	15.5	17.0
Arts	14.5	16.0	20.0
Social sciences	13.0	15.0	19.0
Natural sciences	14.0	15.0	15.0
Technology	11.0	13.0	13.0
Forestry	12.0	17.0	17.5
Veterinary medicine	10.0	9.0	12.0
Agriculture	14.0	19.0	14.0
Pharmacy	13.0	12.0	13.0
Stockholm School of Economics	13.5	11.0	15.5
All faculties	12.0	14.0	14.0

Source: Data supplied by UHA, Stockholm.

Table 26. **United Kingdom: Time taken by PhD students at Cambridge University to complete their studies**

	a)	*b)*	*c)*	*d)*
English	15	20		57.8
Modern languages	16	19	24	67.0
Economics and politics	22			49.2
History	14	19		62.6
Engineering	11	12	14	88.0
Geography and geology	11	13	16	83.5
Mathematics	10	11	14	77.2
Physics and chemistry	10	11	12	91.3
Biology	10	12	13	86.3

a) Number of terms needed for one-third of students to succeed.
b) Number of terms needed for one-half of students to succeed.
c) Number of terms needed for two-thirds of students to succeed.
d) Percentage of students who succeed within 8 years.
Source: ABRC *loc cit* (note 5), Table 3.4.

Table 27. **Sweden: Percentage of new entrants in research education academic years 1972/73 - 1978/79 who were awarded degrees four to ten years after beginning of studies**

Faculty	Year after start	New entrants in academic year:						
		1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79
Arts	4	3	3	2	2	1	2	2
	5	4	4	3	2	2	3	
	6	5	6	4	3	5		
	7	7	8	5	3			
	8	9	10	7				
	9	10	12					
	10	13						
Social sciences	4	3	4	4	4	3	1	1
	5	4	5	6	5	5	2	
	6	5	6	7	6	8		
	7	6	7	9	8			
	8	9	10	12				
	10	14						
Natural sciences	4	4	6	3	2	4	3	2
	5	9	9	5	4	7	5	
	6	14	18	11	10	13		
	7	23	26	20	19			
	8	31	34	28				
	9	36	43					
	10	41						
Medicine	4	17	20	11	12	12	19	15
	5	29	28	20	22	19	23	
	6	35	36	30	31	32		
	7	42	44	41	42			
	8	48	51	49				
	9	55	56					
	10	57						
Technology	4	6	6	5	3	3	5	3
	5	10	11	10	7	6	8	
	6	14	15	17	13	13		
	7	20	19	25	18			
	8	23	23	32				
	9	27	29					
	10	30						
All faculties	4	6	9	5	4	5	5	5
	5	10	13	9	8	8	8	
	6	13	17	14	12	15		
	7	18	22	20	18			
	8	22	26	26				
	9	26	31					
	10	29						

Source: Data supplied by UHA.

apparent lengthening of the period which is required for the preparation of a thesis; and *b)* these problems are very much more acute in the social sciences and humanities.

To some degree, it is likely that the *lengthening* of studies as well as the differences in typical length between fields can be attributed to *part-time* study. As was discussed earlier, not only is there something of a tendency for the extent of part-time study to increase, but also it is more prevalent in precisely those fields (social sciences, humanities) where length and lengthening of study are most problematic. Data from France bear out the association between part-time study and length of doctoral training even in a discipline seemingly less "at risk" – chemistry (see Figure 3). Yet this is not a sufficient explanation.

On the one hand, there remains the problem of non-completion. Is this to be explained in terms of part-time study? If so, one may reasonably ask *why* this should be so. Moreover, there may be other factors which need to be invoked in order to understand non-completion even among students working full-time at their research studies. A number of enquiries have been addressed to these questions. In the United Kingdom a study by Rudd, quoted by the ABRC Report[5], identified the following as amongst the major determinants of failure to complete research training:

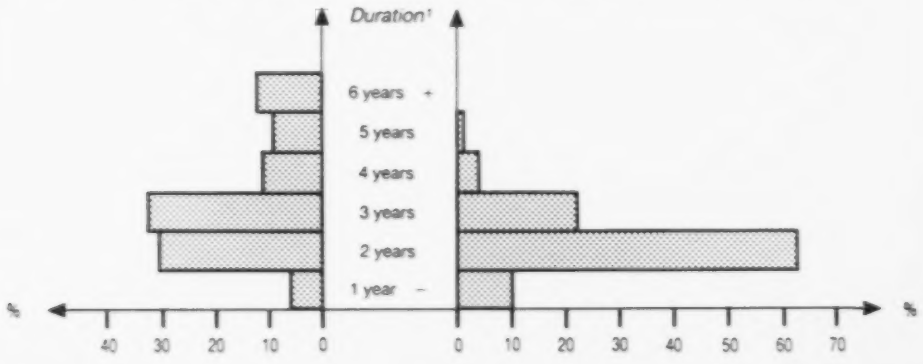
- Poor supervision, especially at the early stages of planning research;
- Lack of knowledge of research techniques;
- Inadequate motivation: some students had just drifted in with no clear purpose other than to continue to enjoy the benefits of university life.

The United Kingdom Working Party on Post-graduate Education also took the views of other relevant individuals and organisations as to the causes of non-completion. The SSRC

Figure 3

FRANCE: TIME BETWEEN OBTAINING THE DEA OR EQUIVALENT AND OBTAINING THE DOCTORATE

Chemistry



1. Students who took 8 or more years to obtain the doctorate were eliminated; they represent 4.5 % of the sample.

Source: APEC, *Les docteurs en chimie* 1983.

(now ESRC), which supports considerable numbers of students receiving research training in the social sciences, referred to "the student's academic quality, his preparedness for research in regard to knowledge of method and techniques, the quality of the research environment, the ambitiousness of the student's research enquiry ...". The implications of Rudd's study and of the views of the SSRC are that the problem is a complex one, of which some part of the explanation is to be sought within the *environment* in which studies are conducted - and in particular the provision made for the student's needs in terms of supervision, etc. – and some part is to be sought within the student him/herself (motivation, willingness and ability to master the knowledge and techniques required).

A study in Norway enquired in detail into research trainees' experience of the guidance/supervision they received. Its findings are significant. It appeared that well over half of all those in recruitment positions (that is, posts set aside for trainee researchers – (Norway has not until recently had anything of a "professionalised" system of post-graduate training) perceived a need for more systematic research training. This was particularly true of the humanities and social sciences. Trainees in these fields appear to have *received* the least supervision, and to be the most dissatisfied with the guidance they received. As to the *ways* in which they considered that their needs could best be met, differences also emerged. About half considered that what they wanted was individual guidance; about one-third preferred to work in a co-operative research team, while a very few preferred research seminars and training programmes. A review of this study by the NAVF Institute for Studies in Research and Higher Education concludes "that recruitment personnel seem to think that informal and individual forms of guidance will be of more use than formal and structured research training programmes. This impression has been substantiated through interviews with research fellows and assistants. Most, however, point out that it would be important to *combine* individual guidance with more structured attempts"[12].

In Sweden, where the problem of non-completion has received considerable attention, a number of detailed studies have been carried out, and very many opinions as to the causes of the problem have been expressed. One recent study, based on interviews with both students and supervisors in a social science faculty, concluded that the external socio-economic circumstances of the student is a major factor:

> "The results indicate that in many respects the research students consulted form a heterogeneous group, with differing experiences and life-situations. There is a lot of evidence to suggest, moreover, that they were studying under widely varying conditions. Those with a high level of activity, for instance, tended more often to have project grants, post-graduate student grants, or jobs at their departments. Overall, those who had completed their doctorate seem to have enjoyed more favourable financial circumstances than the other research students. If we consider socio-economic conditions generally, the youngest PhDs must be regarded as the group with the most favourable conditions for studying. Students who gained their doctorates quickly were characterised, for example, by having had a clear idea of their research specialisation from the outset, having enjoyed financially favourable circumstances, and by having received supervision of a high quality.
>
> Students gaining their doctorate quickly were strongly motivated to complete their course in a short time. They were problem-oriented and began work on their thesis at an early stage. Their families wholeheartedly supported them in their studies. They were physically and mentally resilient and fully convinced of being able to complete their degree successfully. Their financial situation was sound. They had a very favourable opinion of their supervisors and received sound, regular supervision. Their research field was clearly defined.

Those who took a long time to complete their doctorate were less well off financially and not as motivated to complete the programme in a short time. One student changed to another university as a result of problems with her supervisor. In the other case studies completion was delayed due, *inter alia*, to family responsibilities, teaching duties, a mistaken choice of research model, and a demanding research field."[13]

The study also sheds light on personal qualities which, in the opinion of students and of supervisors, make for effective work:

"In the students' opinion, the qualities needed to produce a thesis were above all perseverance, energy, self-confidence, and an ability to concentrate. Inventiveness was rated as more important than either intelligence or a good memory.
Students valued supervisors who were, for instance, widely read, knowledgeable, systematic, methodical, and well-prepared for supervisions. Praise was also expressed for supervisors who had a positive attitude, were active, encouraging, inspiring, stimulating, understanding, friendly, and so on. Supervisors themselves replied, *inter alia*, that they considered limited supervising experience, a lack of competence in a particular field, and insufficient moral courage to dissuade a weak student from continuing, to be factors which hindered effective supervision"[13].

The lessons to be drawn from Swedish experience are complex and important. It is very clear, as Swedish authorities readily admit, that a simple *requirement* that a doctorate be completed in a given period is in itself an insufficient means of dealing with the problem of the dragging outof studies. This has been attempted in Sweden with a notable lack of success. Even when accompanied by effective selection of students - for example in terms of quality of first degree – there remain problems. Some of these relate to qualities of individual students, such as motivation. Others relate to the socio-economic circumstances of students: adequate financial provision – but also the inhibiting effect of social responsibilities which come with increasing age. But just as importantly, constraints may inhere in the environment in which the student has to work and the nature, extent and quality of supervision which he or she receives.

Recent policy discussion in this area has indeed addressed the responsibilities of universities and their staff in this regard. In Sweden it has been suggested, though far from agreed, that departments should considerably reduce the number of beginning research students whom they accept. If numbers were much smaller, it is argued, it would be possible to give much more individual attention. Only full-time students should be accepted. Against this view, it is argued that numbers would shrink too drastically: only about one third of students are willing to work full-time for their doctorates. Moreover, there is the danger that the best of them will be hired away before completing their studies. In the United Kingdom the ABRC Working Party on Post-graduate Education proposed a series of sanctions directed at universities, as well as a requirement that the Research Councils publish regularly statistics by university showing the proportions of the students they support who submit their dissertations within four years. As to the sanctions:

"... each of the SERC and SSRC should have a graded sequence of sanctions which it would apply to any university at which the submission rate relevant to that Council was unacceptably low. The first and weakest of these would be to insist that an award holder had a designated supervisor and research topic before the university received the first instalment of his fees; the reason why we attach importance to this is that delay in the choice of a research topic, or the choice of too ambitious a topic, are two of the main causes of very late submission. The next sanction would be to take account of the university's low submission rate in determining the numbers of its quota awards and

perhaps even in assessing its applications to the pool. A third stage, which we hope would never prove necessary, would be to deprive the university of quota awards altogether until its submission rate improved. In all these cases we recommend that the action be taken in respect of an entire university rather than an individual department within it.

It has been put to us that the second and third stages are too drastic, and that in any case they are aimed at the wrong target; if anyone apart from the student himself is to be blamed for failure to complete, it must be the supervisor, and therefore the sanction should be aimed at the individual bad supervisor rather than at his whole department or his university. The appropriate sanction is obvious enough; it would be that a supervisor proven to be unsatisfactory because of the low submission rate of his research students would not be permitted in future to supervise Research Council supported students.

We have two reasons for rejecting this argument: that it misreads the statistical evidence, and that the proposed sanction would be ineffective. First, we do not believe that failure to submit is to be primarily blamed on the supervisor; we believe it to be a reflection of the ethos of a department or clump of departments."[5]

The British Working Party thus lays responsibility firmly with the university: it is the university department which has the responsibility for selecting good supervisors (or, put another way, "not choosing bad supervisors"). But the implication is profound, for it is implied here that there can be members of university staff who for one reason or another are *not* suited to supervising research students.

Recent developments in France, however, go even further in seeking to ensure the quality both of supervisor and department. More will be said about the restructuring of post-graduate (third cycle) education in France in Chapter 8. For the purposes of the present discussion it is necessary only to draw attention to two aspects of the structure introduced in October 1984. New regulations in France seek in the first place to ensure that doctoral training is located *only* in appropriate settings approved for the quality of the environment they provide to the trainee researcher; and in the second place to restrict the right to supervise the preparation of a doctorate to a senior scientist qualified by the *habilitation à diriger des recherches*.

The assumption underlying the discussion in this section, as in most policy debates of the question of non-completion, has been that it is wasteful, reflects failings in the system, and has to be minimised through policy measures such as those discussed above. A minority of commentators see it differently. Some argue that if one looks at the process of post-graduate study and research not in terms of accreditation, but in terms of the acquisition of new skills and deepened understanding, then failure to achieve the formal end-qualification may be of little significance. Moreover, it has been suggested that students may sometimes enrol for post-graduate study with no real wish to complete the formal programme. It may be, for example, that while the individual looks only for a very specific course – for example to master a particular technique – the university offers this only as part of a larger "package" leading to a higher degree. The student may enrol with no intention of taking the parts of this package in which he or she has no interest. These two objections to the dominant assumption that non-completion is wasteful are of very different kinds and cannot be easily reconciled. The first is essentially a different way of looking at higher education from that perspective, dominated by considerations of effectiveness, managerial efficiency, which today largely dominates. The second objection is rather to the inflexibility of current arrangements, and implies the need for a more *à la carte* approach to the structuring of courses offered at the post-graduate level: a greater sensitivity to changing social and economic needs. Non-completion statistics, according to this view, are thus to some degree a measure of the failure of the system to respond adequately. This point is taken up again in the conclusions of the report.

Chapter 7

THE EMPLOYMENT AND UNEMPLOYMENT OF HIGHER DEGREE GRADUATES

It is clear from the various country reports that whilst the employment situation of university graduates is better than that of the working population as a whole, it has nevertheless been affected by the generally difficult economic situation in which Member countries find themselves. The implications of economic circumstances for post-graduate study, and the employment of holders of post-graduate degrees, are complex. In the first place, the demand for post-graduate training (discussed in Chapter 3) is likely to be affected in ways which are not easy to specify. For example, there is little doubt that in the 1960s and 1970s – and perhaps particularly in the social sciences – post-graduate research seemed to offer many students an escape from a world of work of which they disapproved. Similarly, a lack of suitable employment prospects might under some circumstances lead to a higher demand for further study as a means of postponing unemployment or of improving employment prospects. According to some commentators, therefore, there is a difference between a group of post-graduate students not essentially oriented to employment at all, and a second group seeking either to postpone employment decisions or to improve its employment chances by acquiring marketable skills. At times of high demand, and especially in fields of high industrial demand for highly-trained graduates, further study may seem economically unwise. In certain areas of engineering, natural sciences and computing, the opportunity costs of continuing with post-graduate study have simply been too great (posing serious problems for universities in seeking to develop their own research in these fields).

As statistics in Tables 28 to 34 show, holders of PhDs in particular and *a fortiori* of the "pre-professionalised" doctorates (awarded in a number of Member countries) have typically been oriented above all to university employment. But for reasons of economy, as is well known, there have been major cutbacks in the universities which have resulted in a profound shortage in academic positions. The Australian case study puts the matter in stark quantitative form:

> "Over the period 1980 to 1983, the university system recruited only around 300 new full-time tenured staff per year out of a full-time teaching force of about 8 000. In the statistical year ending 30 April 1984, only 166 university academic staff resigned their posts while a mere 119 retired. The problem is further compounded because of a concentration of current academic staff in the 35-44 year age bracket. Only about 9 per cent will retire in the next decade" (p. 56).

This general pattern, which of course is not limited to Australia, has naturally had major implications for the employment prospects of higher degree graduates.

Questions relating to the employment of holders of higher degrees have always been central to the policy-makers' concern with this level of higher education. The precise questions in the light of which policy assessments are made, however, change with time. This is

particularly the case in regard to those being trained in research, where concerns with oversupply and unemployment, and shortage in relation to the manpower needs of the research system, seem endlessly to follow each other. A decade or two ago, when manpower planning seemed to promise more than it does today, there were many OECD countries in which the hope of bringing the supply of research-trained manpower into line with "requirement" was widely entertained. Few now believe in the possibility of tailoring the supply of new researchers to the needs (or the demands) of the research system as a whole. But the hope has been abandoned only with regret. Practical realisation that assessments of demand (let alone need) for qualified scientists were of little value, and that (in many cases) the policy instruments to control output were not available, forced abandonment of this objective. Now, to be sure, it arises in more modest form, as governments confront those new sciences and technologies in which so much hope is vested. It was shown, for example, that in the United Kingdom almost all the planned growth in financial support for post-graduate training would take place in information technology, biotechnology, and so on (see Chapter 4).

The way in which underlying concern in this area has evolved is well illustrated by the Swedish case. Here, manpower planning – the "dimensioning" of post-graduate education – arose at the end of the 1960s when the post-graduate student population was rising rapidly. It was feared that many of those training in research would be unable to find jobs of a suitable kind. However, the expected problem of surplus never arose. Admissions to post-graduate study began to decline, and the numbers taking degrees – entering the labour market with a post-graduate degree – fell very rapidly. However, the problem then began to emerge in the contrary form. How could the anticipated shortage of persons with higher degrees, especially in science and technology, be avoided? The Swedish Research Policy Bill of 1982 gives the National Board of Universities and Colleges (NBUC) the task of keeping supply of post-graduates and the employment situation under observation.

A further aspect which has often been raised when these employment aspects of post-graduate training are considered is the question of whether, in their employment, holders of higher degrees actually make *use* of the skills which they have acquired. Are they in this sense satisfied? Or is it rather that employers (presumably excluding the universities) simply take possession of a higher degree as an indicator of academic quality, and appoint without reference to the job which is to be done? In this context very sceptical comments have been expressed. Thus, in reference to the Working Party on Post-graduate Education in the United Kingdom, one of the professional institutions in the engineering field was: "It is, we believe, widely accepted that the traditional PhD-type of training is of limited relevance to industrial problems." In this chapter, available data on the *employment* of higher degree graduates are assembled, together with the results of a number of studies of *use* made of post-graduate training in subsequent employment.

In the United States, extremely comprehensive data are available on the employment of the nation's stock of higher-degree-holders. Table 28 shows that in 1981, of the total stock of 343 500 holders of the doctoral degree in science and engineering, some 54 per cent were employed within the education system. This compares with 58.7 per cent in 1973. However, there are very large differences between fields in which the PhD was obtained. Thus, only 33 per cent of computer scientists and 32 per cent of engineers worked in universities and other educational institutions, compared with 74 per cent of social scientists. Another way of looking at the employment of the stock of scientists and engineers is in terms of the functions they fulfil, i.e. the kind of work they do. Table 29 shows how the 343 500 doctoral-level scientists and engineers were divided between various principal functions. It shows that, in 1981, 30.0 per cent of men (34.0 per cent women) worked principally in teaching; 29.8 per

Table 28. **United States: Employed doctoral scientists and engineers by field, sex, and sector of employment: 1973-1981**

Field and sex	Total			Business and industry			Educational institutions			Federal government			All other employers[2]		
	1973	1979	1981	1973	1979	1981	1973	1979	1981	1973	1979	1981	1973	1979	1981
All S/E fields	220 400	313 800	343 500	53 400	82 800	99 000	129 400	174 000	186 800	18 200	23 900	25 100	19 400	33 000	32 600
Men	203 500	280 400	302 600	52 000	78 200	91 800	117 200	152 100	161 000	17 200	22 300	23 100	16 900	27 800	26 700
Women	17 000	33 300	40 900	1 400	4 600	7 200	12 200	21 900	25 800	1 000	1 600	2 000	2 500	5 300	5 900
Physicists	48 500	60 200	63 200	19 700	25 000	27 400	22 000	27 200	28 300	4 100	4 600	4 300	2 700	3 300	3 100
Men	46 600	57 000	59 400	19 400	24 200	26 300	20 700	25 400	26 300	4 000	4 400	4 100	2 600	3 000	2 800
Women	1 900	3 100	3 800	300	800	1 100	1 300	1 800	2 100	100	200	200	100	300	400
Mathematicians	12 100	15 300	15 600	900	1 400	1 600	10 500	12 600	12 700	500	800	900	300	400	400
Men	11 400	14 200	14 300	800	1 400	1 500	9 700	11 700	11 700	500	800	800	300	400	300
Women	800	1 100	1 300	[3]	100	100	700	1 000	1 100	[3]	[3]	100	[3]	100	[3]
Comput. special.	2 700	6 700	9 000	1 000	3 700	5 200	1 400	2 500	3 000	100	300	400	200	300	500
Men	2 600	6 400	8 300	1 000	3 500	4 800	1 300	2 300	2 800	100	300	300	200	300	500
Women	100	400	700	[3]	[3]	400	[3]	100	300	[3]	[3]	[3]	[3]	[3]	[3]
Environment scientists[1]	10 300	14 600	16 000	2 200	4 200	4 800	5 200	6 200	6 800	2 000	2 700	3 100	1 000	1 500	1 400
Men	10 100	14 000	15 200	2 200	4 100	4 600	5 000	5 900	6 400	1 900	2 600	2 900	900	1 400	1 300
Women	300	600	900	[3]	100	200	200	300	400	[3]	100	100	[3]	100	100
Engineers	35 800	50 300	57 000	17 800	26 400	31 700	13 000	17 000	18 100	2 700	3 600	3 800	2 300	3 200	3 400
Men	35 600	49 700	56 200	17 700	26 200	31 200	13 000	16 900	17 900	2 700	3 500	3 800	2 300	3 100	3 300
Women	100	500	800	100	300	400	100	200	200	[3]	[3]	[3]	[3]	[3]	100
Life scientists	58 000	80 100	86 700	7 200	11 500	13 500	39 200	52 200	56 800	6 100	7 500	7 600	5 500	8 900	8 900
Men	51 900	68 900	73 500	6 900	10 600	12 200	34 700	44 100	47 300	5 600	6 800	6 800	4 700	7 500	7 200
Women	6 100	11 100	13 200	300	900	1 300	4 600	8 100	9 500	500	700	800	700	1 400	1 600
Psychologists	24 900	38 000	43 100	3 100	7 100	10 100	15 100	19 900	21 800	1 200	1 100	1 200	5 400	9 900	9 900
Men	20 100	28 800	31 200	2 600	5 300	7 100	12 200	15 200	15 800	1 000	900	1 000	4 200	7 400	7 200
Women	4 800	9 200	11 900	500	1 800	3 000	2 900	4 800	6 000	200	200	200	1 300	2 500	2 700
Social scient.	28 100	48 700	52 900	1 600	3 500	4 700	23 000	36 300	39 300	1 500	3 300	3 900	2 000	5 600	5 100
Men	25 200	41 400	44 500	1 500	3 000	4 100	20 600	30 700	33 000	1 300	2 900	3 300	1 800	4 700	4 100
Women	2 900	7 200	8 400	100	400	600	2 400	5 500	6 300	100	400	500	300	900	1 000

1. Includes earth scientists, oceanographers, and atmospheric scientists.
2. Includes non-profit organizations, hospitals/clinics, military, state, local and other government, other, and no report.
3. Too few cases to estimate.

Note: Detail may not add to totals because of rounding.

Source: National Science Foundation, *Characteristics of Doctoral Scientists and Engineers in the United States* (biennial series, 1977-1981), and unpublished data. *Science Indicators 1982*.

cent men (28.1 per cent women) principally in research, and 10.2 per cent men (3.7 per cent women) in the management of R&D. Over time, the major trend is a decline in the share of PhD-holders working in teaching over this 8-year period. There is also, and more surprisingly, a decline in the share working in the management of R&D. A further interesting statistic is given in Table 30. The "doctoral intensity of the science and engineering workforce" shows the share of all those working in science and engineering jobs who in 1976 and in 1981 held the doctoral degree. There is a clear overall decline – less working scientists hold doctoral degrees than used to in the mid-1970s. (Trend data were not available for engineers, though it is clear that engineers are very much less likely to hold a doctoral degree). However, set against this general decline are considerable *rises* in categories of medical scientists, and "other social scientists" (i.e. excluding economists, sociologists and anthropologists). The implication would appear to be that those intending to work in science and engineering have found doctoral work of declining importance. This may be associated with the declining share looking for, and finding, jobs in the higher education system. But whatever the nature of the work they do, American doctoral graduates are rarely unemployed. The unemployment rate declined from 1.2 per cent in 1977 to 0.8 per cent in 1981; it has remained consistently slightly below the unemployment rate for all scientists and engineers. Low unemployment rates, however, may conceal adjustment problems of other kinds, as the Australian case study shows:

> "About 50 per cent of higher degree graduates find jobs in research in universities, research organisations or government agencies, though frequently such jobs (especially in universities) are temporary. Others are employed as public servants, as academic staff in universities or CAEs, and in the professions. Unemployment rates are low. Between 20 and 30 per cent of PhD graduates usually proceed overseas directly on graduation, either for postdoctoral research appointments or employment. There are few opportunities for PhDs to find employment in Australia in the private sector" (p. 45).

Data somewhat akin to those for the United States given in Tables 28 and 29 are available for the United Kingdom also. Tables 31 and 32, from a sample survey, show the occupational and sectoral distribution of male graduates with various levels of qualification in the workforce in 1977. In Table 32 the lines labelled "PhD" should be comparable with United States data. They show, although numbers of PhDs are rather small in the total sample and thus obviously subject to very large sampling error, that the percentages employed in the education system were, for engineering 10 per cent, for science 39 per cent, for social sciences 68 per cent, and for arts 64 per cent. For all subjects together, the percentage was 39 per cent. Clearly the education system in the United Kingdom holds a smaller percentage of the total stock of PhDs than is the case in the United States (except in the social sciences and, perhaps, in the arts). The difference is particularly striking in technology and engineering (if these figures are to be believed). But only 31 per cent (all subjects) of PhDs have entered industry and commerce, compared with 32 per cent of Master's graduates and 57 per cent of first degree graduates. Table 33 shows the first employments of people leaving the British universities with a higher degree in science, engineering or social science in academic year 1979/80. For a variety of reasons it can only be compared very roughly with the "stock" data of Tables 31-32. Of the 7 177 graduates, 17 per cent already had jobs on graduation (presumably these were largely part-time students: the sectors in which they were employed are not given); 1 491 or 48 per cent of the total who gained permanent home employment entered industry/commerce; while 27 per cent of them remained within the education system, either to continue their studies or in employment.

Over the past two decades or so, a considerable number of enquiries and surveys have tried to explore the use made of the skills and knowledge acquired in research training,

Table 29. **United States: Employed doctoral scientists and engineers by field, sex, and primary work activity: 1973-1981**

Field and sex	Total			Research			Development			Management of R&D		
	1973	1979	1981	1973	1979	1981	1973	1979	1981	1973	1979	1981
All S/E fields	220 400	313 800	343 500	63 000	84 700	101 700	8 500	15 000	18 400	32 900	43 000	32 600
Men	203 500	280 400	302 600	58 500	75 900	90 200	8 400	14 500	17 600	31 900	41 000	31 100
Women	17 000	33 300	40 900	4 500	8 800	11 500	200	500	800	1 000	2 000	1 500
Physical scientists	48 500	60 200	63 200	18 000	21 100	26 600	1 900	2 800	3 100	8 800	12 700	8 700
Men	46 600	57 000	59 400	17 400	20 000	25 000	1 900	2 700	2 900	8 600	12 300	8 500
Women	1 900	3 100	3 800	600	1 200	1 600	[3]	100	200	100	300	200
Mathematical scientists	12 100	15 300	15 600	2 500	3 100	3 000	200	500	400	500	500	300
Men	11 400	14 200	14 300	2 400	3 000	2 800	100	500	400	500	400	300
Women	800	1 100	1 300	100	100	200	[3]	[3]	[3]	[3]	[3]	[3]
Computer specialists	2 700	6 700	9 000	500	900	1 500	600	2 100	3 000	400	1 000	800
Men	2 600	6 400	8 300	500	900	1 400	500	2 000	2 800	400	900	800
Women	100	400	700	[3]	[3]	100	[3]	100	200	[3]	[3]	[3]
Environmental scientists[1]	10 300	14 600	16 000	3 500	5 200	6 000	100	400	300	2 000	2 400	2 400
Men	10 100	14 000	15 200	3 400	4 900	5 700	100	400	300	1 900	2 300	2 300
Women	300	600	900	100	300	400	[3]	[3]	[3]	[3]	100	100
Engineers	35 800	50 300	57 000	8 300	10 000	13 500	5 000	7 800	9 900	8 300	12 500	10 300
Men	35 600	49 700	56 200	8 200	9 800	13 300	4 900	7 700	9 700	8 300	12 400	10 200
Women	100	500	800	[3]	200	200	[3]	100	100	[3]	100	100
Life scientists	58 000	80 100	86 700	23 400	32 600	38 800	500	900	1 100	8 300	9 500	6 800
Men	51 900	68 900	73 500	20 600	27 800	32 400	400	700	900	8 000	8 800	6 300
Women	6 100	11 100	13 200	2 800	4 800	6 400	[3]	200	100	400	800	500
Psychologists	24 900	38 000	43 100	3 200	4 600	5 000	200	300	400	2 400	1 600	1 100
Men	20 100	28 800	31 200	2 700	3 600	3 800	100	200	300	2 100	1 300	800
Women	4 800	9 200	11 900	500	1 000	1 100	[3]	[3]	100	300	300	200
Social scientists	28 100	48 700	52 900	3 600	7 200	7 300	200	200	200	2 200	3 000	2 300
Men	25 200	41 400	44 500	3 200	6 000	5 900	100	200	200	2 000	2 500	1 900
Women	2 900	7 200	8 400	400	1 200	1 400	[3]	[3]	[3]	200	400	400

Table 29. *(continued)*

Field and sex	Management			Teaching			Other activities[2]		
	1973	1979	1981	1973	1979	1981	1973	1979	1981
All S/E fields	13 300	29 200	27 700	80 000	91 900	105 000	22 800	49 900	58 200
Men	12 500	26 100	24 200	72 500	80 500	91 000	19 800	42 400	48 400
Women	800	3 100	3 500	7 500	11 400	13 900	3 000	7 500	9 700
Physical scientists	2 200	3 600	3 200	14 300	14 400	15 600	3 300	5 600	6 000
Men	2 100	3 400	3 000	13 400	13 400	14 500	3 100	5 300	5 600
Women	100	200	200	900	1 000	1 100	200	300	400
Mathematical scientists	500	1 300	1 000	8 100	8 900	9 600	500	1 000	1 300
Men	400	1 200	1 000	7 500	8 100	8 700	400	900	1 200
Women	[3]	100	[3]	600	800	900	100	100	100
Computer specialists	200	700	900	900	1 100	1 500	100	900	1 300
Men	200	700	900	900	1 100	1 400	100	800	1 200
Women	[3]	[3]	[3]	[3]	100	100	[3]	100	100
Environmental scientists[1]	600	1 200	1 200	3 100	3 000	3 600	1 000	2 400	2 500
Men	600	1 200	1 200	3 000	2 800	3 400	900	2 400	2 300
Women	[3]	100	100	100	100	200	[3]	100	200
Engineers	2 200	4 200	4 900	8 900	9 300	10 700	3 100	6 400	7 600
Men	2 200	4 200	4 900	8 800	9 300	10 600	3 100	6 300	7 500
Women	[3]	[3]	[3]	[3]	100	[3]	[3]	100	200
Life scientists	2 600	6 800	5 700	18 100	19 200	22 000	5 000	11 200	12 400
Men	2 400	6 000	4 800	15 900	15 900	18 400	4 600	9 800	10 700
Women	200	800	900	2 200	3 200	3 600	500	1 400	1 700
Psychologists	2 500	5 000	4 800	9 300	10 400	12 600	7 300	16 100	19 300
Men	2 200	4 000	3 500	7 500	8 000	9 300	5 400	11 700	13 400
Women	400	1 000	1 300	1 800	2 400	3 300	1 900	4 400	5 900
Social scientists	2 400	6 400	6 000	17 300	25 600	29 300	2 400	6 200	7 800
Men	2 300	5 500	5 100	15 400	21 900	24 700	2 100	5 300	8 700
Women	100	900	1 000	1 900	3 700	4 600	300	900	1 100

1. Includes earth scientists, oceanographers, and atmospheric scientists.
2. Includes consulting; production/inspection; sales/professional services; reporting, statistical work and computing; other; and no report.
3. Too few cases to estimate.

Note: Detail may not add to totals because of rounding.

Sources: National Science Foundation, *Characteristics of Doctoral Scientists and Engineers in the United States* (biennial series, 1977-1981), and unpublished data.

particularly by industry. To what extent does the industrial employer value these skills? Would it be possible to "retailor" either the nature of the training or the distribution between fields of study more closely to meet the needs of employers? Reviewing recent British findings, Hirsch reaches two rather important conclusions.

> "In spite of industry's tendency to express opinions about qualifications in specific subject areas, the qualities of higher degree graduates which are actually valued by industrial employers appear to be more general. They include intellectual ability, maturity, breadth of experience and initiative and independence. This would tend to argue against attempting to produce highly specialised postgraduates in subject areas closely geared to current needs as expressed by industrial employers.
> There are three further factors which reinforce this view. First, the research and development function in industry is notoriously subject to stop-go policies, making forward planning for particular kinds of recruits very hazardous. Secondly, substitution

Table 30. **United States: Doctoral intensity[1] of the science and engineering workforce: 1976 AND 1981**

Field	1976	1981
All S/E fields	11.6	11.0
All scientists	19.7	17.3
Physical scientists	30.6	30.4
Chemists	28.1	28.4
Physicists and astronomers	36.7	35.4
Mathematical scientists	16.1	11.7
Mathematicians	19.4	14.5
Statisticians	10.3	6.0
Computer specialists	2.3	2.2
Environmental scientists	19.4	15.4
Earth scientists	17.9	15.3
Oceanographers	47.3	63.6
Atmospheric scientists	18.9	9.6
Life scientists	24.6	21.1
Biological scientists	30.8	24.2
Agricultural scientists	13.2	9.6
Medical scientists	32.8	53.0
Psychologists	29.1	32.8
Social scientists	17.7	23.4
Economists	18.1	16.4
Sociologists and anthropologists	21.0	18.3
Other social scientists	16.4	34.0
All engineers	3.7	3.8
Aeronautical engineers	n.a.	5.0
Chemical engineers	n.a.	9.0
Civil engineers	n.a.	2.9
Electrical and electronic engineers	n.a.	3.8
Mechanical engineers	n.a.	2.2
Other engineers	n.a.	4.1

1. Employed doctoral scientists and engineers as a percent of all employed scientists and engineers.
n.a. Not available.
Sources: National Science Foundation, *U.S. Scientists and Engineers, 1980* (NSF 82-314); *Characteristics of Doctoral Scientists and Engineers in the United States* (biennial series, 1977-1981); and unpublished data.

Table 31. **United Kingdom: Occupational distribution of graduates by subject and type of degree – 1977**

Percentages

	MEN									
	Teacher	Engineer	Scientist	Legal	Business Services	Management professions	Other	Manager	Other	Total
Engineering/technology										
None	3	54	1	–	–	–	1	24	15	608
MA	7	65	2	–	–	–	1	16	8	96
PhD	6	46	12	–	–	–	2	6	28	50
Other	9	51	1	–	2	–	3	22	9	368
Science										
None	9	10	19	–	2	1	2	24	33	554
MA	25	7	25	2	1	4	3	12	22	124
PhD	26	5	45	–	–	2	1	10	11	243
Other	47	2	3	3	8	2	2	13	20	334
Social studies										
None	11	–	–	10	7	2	7	41	19	335
MA	28	3	1	6	3	13	6	32	7	194
PhD	48	–	7	3	–	13	13	13	3	31
Other	23	–	–	26	16	1	4	18	7	552
Arts										
None	30	–	–	2	1	–	12	34	20	162
MA	46	2	–	16	2	–	16	8	10	61
PhD	64	–	–	4	–	–	20	4	8	25
Other	48	–	–	14	3	–	11	11	12	265
Other										
None	5	4	8	1	–	–	3	30	48	125
MA	35	3	14	–	–	–	5	14	30	37
PhD	30	3	32	3	–	–	5	8	27	37
Other	23	4	2	6	5	1	2	14	45	110
Architecture										
All	11	4	1	–	2	4	4	9	9	86
All Subjects										
None	9	22	7	2	2	1	4	29	24	1 793
MA	25	14	7	4	2	6	6	19	12	562
PhD	28	9	33	1	–	2	4	8	14	390
Other	29	12	1	12	8	1	4	16	13	1 652
Total	20	16	7	6	4	2	4	21	18	100
	(878)	(705)	(306)	(266)	(184)	(72)	(181)	(914)	(780)	(4 397)

Note: The table excludes men working in Architecture and related occupations. Just 111 men were employed in this occupation (or about 3 per cent the total sample). They are included in the individual row totals shown in the last column of the table.

Source: ABRC *loc cit* (note 5), Table 7.

between subjects and levels of qualification, even in the research function, appears to be possible and even beneficial. Thirdly, recruits into industry are actually entering careers in research which may span many years and many changes of technology, and quite often lead to research management or movement out of research altogether. Companies, in their desire to control manpower growth, are having to use all employees, including scientists and engineers, much more flexibly during the course of their careers. Consideration of the labour market for higher degree graduates outside the universities

Table 32. **United Kingdom: Sectoral distribution of graduates in employment by subject and type of highest post-graduate qualification achieved - 1977**

Percentages

	MEN								
	Public sector	University teacher	Polytechnic teacher	Other educational	Industry	Commerce	Private professions	Other	Total
Engineering/technology									
None	21	1	1	1	64	4	3	6	608
MA	28	2	4	2	50	4	9	–	96
PhD	18	6	2	2	52	6	6	8	50
Other	35	–	2	7	39	4	11	3	368
Science									
None	20	2	1	8	44	17	–	7	554
MA	31	9	7	15	27	4	2	6	124
PhD	20	27	3	9	29	3	1	9	243
Other	16	1	4	42	17	8	7	6	334
Social studies									
None	21	4	4	6	30	18	9	8	335
MA	24	11	12	6	26	12	2	7	194
PhD	13	58	7	3	10	–	3	7	31
Other	20	1	6	18	13	13	25	5	552
Arts									
None	24	6	4	22	14	13	2	15	162
MA	10	13	10	33	5	2	3	25	61
PhD	12	48	4	12	–	4	–	20	25
Other	14	5	5	41	5	6	8	17	265
Other									
None	17	–	1	4	22	31	7	18	125
MA	30	14	5	24	11	5	3	8	37
PhD	32	16	8	14	11	5	3	11	37
Other	23	1	3	18	15	23	15	4	110
Architecture									
All	56	1	5	5	9	3	17	3	86
All Subjects									
None	21	2	2	6	44	13	4	8	1 793
MA	29	8	9	12	25	7	4	7	562
PhD	20	27	4	8	27	4	2	10	390
Other	22	1	4	24	18	9	15	7	1 652
Total	22	5	4	14	30	10	8	8	100
	(977)	(209)	(163)	(598)	(1 335)	(442)	(339)	(334)	(4 397)

Source: ABRC *loc cit*, Table 8

offers little evidence of any research employment in the humanities and there appears to be a limited demand for those with extended professional training (e.g. in economics and business studies) in the social sciences. There is almost no evidence of any demand for PhDs in engineering but the same cannot really be said of other science subjects. The complex pattern of industry's needs for various kinds of research and development manpower appears to span both PhD and MSc graduates at present, but our understanding of these labour markets is still limited and based on the often contradictory views of employers. The practical problems of dealing with this kind of labour market and the views of employers on the skills they really value appear to argue against gearing the PhD to industry's short-term requirements for specialists."[11]

Table 33. **United Kingdom: First destination of higher degree graduates from universities**

1979-80 Academic year

	FE or training	Gained permanent home employment					Already in employment	Not available for employment	Temp. home employment	Believed unemployed	Other known destinations	Destination not known	Total grads
		Education	Public source	Industry	Other	Total							
Engineering, etc. (Total Group III)	176	121	78	460	9	668	320	7	8	19	89	218	1 505
Per cent	12	(18)	(12)	(69)	(1)	45	21	–	–	1	6	14	100
Natural science, etc. (Total Group V)	681	388	247	674	19	1 328	362	28	16	60	158	438	3 071
Per cent	22	(29)	(19)	(51)	(1)	43	12	1	–	2	5	14	100
Social science, etc. (Total Group VI)	240	332	333	357	89	1 111	535	35	11	53	62	554	2 601
Per cent	9	(30)	(30)	(32)	(8)	43	21	1	–	2	2	21	100
Total	1 097	841	658	1 491	117	3 107	1 217	70	35	132	309	1 210	7 177
Per cent	15	(27)	(21)	(48)	(4)	43	17	1	–	2	4	17	100

Note: Figures in brackets are percentages of those gaining permanent home employment who entered the different sectors.

Source: ABRC *loc cit*, Table 6.

The conclusions, in other words, are that *i)* in the majority of disciplines (including the arts, most disciplines of the social sciences, and most of engineering) there essentially *is no labour market for PhDs*; *ii)* it makes little sense to try to tailor output to expressed needs of employers at any greatly disagreggated level. The skills sought are general, and substitution is too widespread (and perhaps desirably so).

In the case of France, a series of extremely interesting results are available from the regular studies carried out by the Ministry of Research and Technology (and previously by the DGRST) and the *Association Bernard Grégory*. These provide insights not only into the employment position of recipients of doctoral degrees, but also into the process of "becoming employed". The studies are carried out on a subject basis (and only certain subjects are surveyed), and by means of a postal questionnaire (with obvious limits of validity posed by possibly biased non-response). The procedure is annually to survey all those who received their *doctorat de troisième cycle* in the previous 4-5 years, thus yielding a regularly updated picture of recent graduates. Data from a number of these surveys are summarised in Table 34. The extent of variation betwen fields is striking. Noteworthy is the extent to which doctoral graduates in the humanities are retained in the higher education system; the broad spread of employment of social science graduates (though here too with a bias to education); and the relatively high movement of chemistry graduates into industry (a percentage which appears to be increasing).

It is not possible here to do justice to the wealth of information contained in these survey reports. A number of points may, however, be noted. In the first place, there is conclusive evidence of the variation between universities, even within a precisely defined specialism, in terms of sector of employment. Figure 4 shows the length of time taken to find an employment by those obtaining a doctorate in chemistry between 1977 and 1981. Thus, whilst approximately 50 per cent of the total were employed within 3 months of obtaining their degrees, 6-9 months were required for 80 per cent to be employed. The difference of 2 months is accounted for by the fact that those who took their doctorate after a first qualification in engineering were more rapidly employed than those who had first graduated in chemistry

Table 34. **France: Employment of recipients of *doctorat de troisième cycle* for selected fields**

Percentage distribution

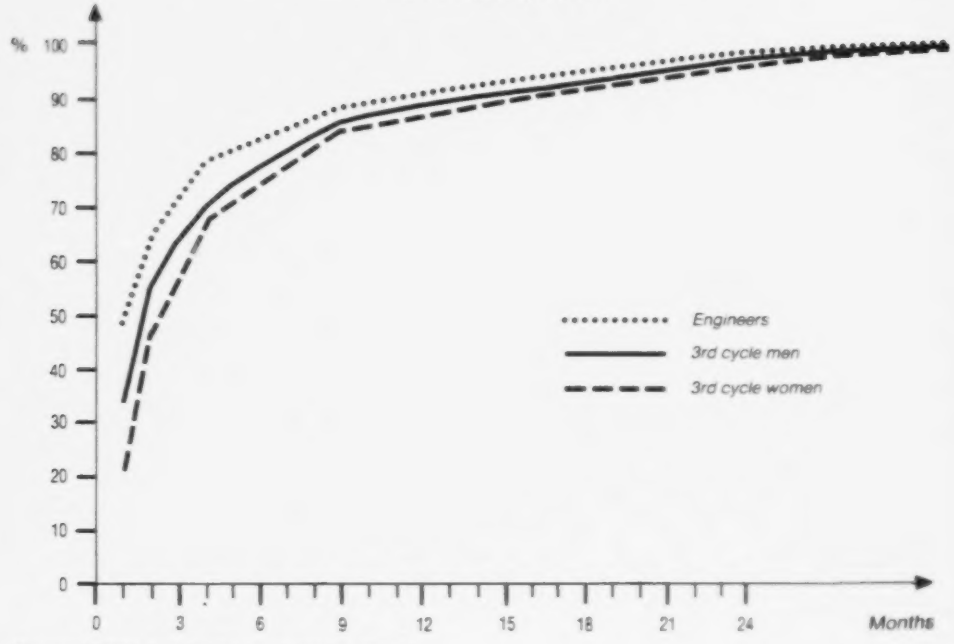
Sector	Humanities[1]	Social science[1, 4]	Biology[1]	Physics[2]	Chemistry[1]	Chemistry[3]
Public education system[5]	79	46	32	27	24	22
Public research system[5]	6	14	32	27	20	22
Other public sector	3	18	5	5	3	2
Private sector[5]	5	17	17	24	37	45
Liberal professions	2	4				
Other (including unemployed)	5	1	14	17	16	9
	(N = 178)	(N = 852)	(N = 1 443)	(N = 525)	(N = 1 309)	(N = 568)

1. Obtaining doctorat between 1975 and 1980.
2. Obtaining doctorat between 1973 and 1978.
3. Obtaining doctorat between 1977 and 1981.
4. Category includes "sciences sociales" + géographie, droit, sciences politiques and économie.
5. "Public education system" includes both higher and secondary education.
   "Public research system" incudes CNRS, CEA, INSERM, etc.
   "Private sector" includes the "Centres techniques".

Sources: Various survey reports published by DGRST/APEC/ASS. Bernard Grégory between 1979 and 1983.

Figure 4

FRANCE: TIME TAKEN BY DOCTORS IN CHEMISTRY TO FIND EMPLOYMENT, 1977-81



Source: APEC, *Les docteurs en chimie*, 1983.

from a university. Moreover, women took on average longer to find employment than men. In a number of these studies eventual employment was compared with the wishes of sudents *entering* doctoral training. So far as chemistry was concerned, one report notes that whilst those employed in the public sector (whether in teaching or research) were satisfied, those who entered the private sector – even when employed in the research post they had wanted – were more "*nuancés*". They frequently indicated that they would rather have obtained employment in the public sector. A final point to be made relates to research training in the humanities. Comments of recent graduates are indicative of their perception of the "market value" of their diploma.

> "Since the doctorate in humanities has no real outlet and since it is too lengthy to be prepared as a further education course, in practical terms it is totally useless. It might as well be suppressed" (a 33-year-old).
> "It is very difficult to find research work in the private sector.... Holding a doctorate without real experience in the private sector appears to be a true handicap (higher age on the one hand, and on the other, employers' reluctance to one pursuing university studies after the master's degree" (a 32-year-old).
> "In the public sector, degrees are of no use, except in universities and the CNRS" (a 32-year-old).

In Norway, with a very different research training system to that of France – and which has become more "professionalised" (in certain fields) only in the last few years – the situation is nevertheless rather similar. The results of a questionnaire survey among those preparing their doctorates (so-called "recruitment personnel") in the universities show a large gap between the generally-desired academic career and perceived prospects of obtaining such employment. Whilst 60 per cent said that they would prefer university or college employment, only 5 per cent thought they had possibilities for obtaining such a good job; 27 per cent thought that they had good employment prospects outside academia, but only 21 per cent actually chose this as first preference. Comparable to the situation in France, students in the humanities were particularly negative in their perceptions of the usefulness of their qualification outside the university: 50 per cent doubted that they would find employment outside in which they could use their training. In terms of *actual* employment, Norwegian data support the notion that research-trained people have, as it were, been pushed out of the academic system. A comparison was made between a cohort beginning its training (in a recruitment post) in 1961, with a second cohort beginning in 1969, in terms of employment eight years later (so in 1969 and in 1977). Data show that the percentage employed in the university declined significantly (58 per cent of research fellows and 39 per cent research assistants in the first case, compared to 49 and 28 per cent in the second). A Norwegian review of this study notes that "It is reasonable to believe that these figures represent the difficulty of becoming employed by universities and colleges and not that the recruitment personnel actively sought employment in other sectors".

It is clearly difficult to reach any general conclusions on the basis of these very partial data. It would appear reasonable to conclude, in general, that *i)* humanities and social science graduates have typically been retained by the higher education system to a greater extent than other graduates; *ii)* that research training frequently gives rise to a wish for academic/research employment but that this is frequently not realised; *iii)* that the share of holders of the doctoral degree remaining in the university has declined over the past decade (which of course is unsurprising given the meagre employment opportunities during this period). Information on the relevance/usefulness of a doctoral degree in non-academic employment is scanty. Experience from the United Kingdom suggests that even in engineering it is not valued. In the humanities the opinion of graduates themselves supports a sense of its irrelevance. All of this has of course much to do with shifts in science and technology policy over the past decade, as well as with university policy. At a time when in many countries investments both in public and private sector R&D were declining, opportunities for the exercise of newly-acquired research skills were correspondingly meagre. Today there seems to be a new period of growth, but limited to certain defined fields of science and technology. Here shortages are announced by those looking for rapid growth in investment in informatics, biotechnology, materials science, and so on. It would seem that a very much more differentiated labour market for those training in research now exists. There is a sharply defined area characterised by large public and private investment in new R&D and having an apparent shortage. The extent to which these shortages are typically being met through recruitment from universities in the home country (as against, for example, recruitment internationally, or through retraining) is unanswerable from the data available here. But the fact that these possibilities exist, and are perhaps being used, should caution against any very precise attempt at manpower planning even here. Second, there is the broad range of physical and natural sciences, in which jobs exist, but where employers may be looking for general skills and general research ability of wide applicability. Not all the jobs for which employers seek PhDs in this category are research jobs. Finally, so far as the humanities and some of the social sciences are concerned, it is doubtful if it makes much sense to speak of a labour market at all. There would appear to be

virtually no demand for the skills and knowledge acquired during preparation of a doctorate in these areas, outside the academic system. Superimposed upon these differences between the various broad fields of specialisation, are of course major differences between the various national systems. For while contraction in the availability of academic career posts has been a very general phenomenon, characteristic of many Member countries, the capacities of industrial systems to make use of the newly graduating PhDs have of course been very different. In Australia, for example, opportunities for employment of PhDs in the private sector have scarcely emerged, and it may be that one must speak here in terms of a brain drain, for considerable shares of newly graduating PhDs go immediately abroad.

It would be mistaken to base post-graduate education policies closely upon such manpower considerations, and there seems little inclination to do so. There is by now sufficient appreciation of, in the first place, the *impossibility* of such planning (as experience in the 1960s made clear). Beyond that, there is a growing recognition of the magnitude of the contribution which post-graduate students make to the research activity of the university system. In a number of Member countries attempts have been made to calculate this magnitude. In the Australian case, for example, Powles estimated that, in terms of staff hours spent on research, post-graduate students accounted for 43 per cent of all university research. In the case of Norway, Kyvik has calculated that "recruitment personnel do about as much research as do permanently employed academic personnel." i.e. about 50 per cent[12].

In Table 35 approximate order of magnitude calculations of this contribution in the natural sciences and engineering are given for a number of other countries. In every instance, the contribution of post-graduate students to university research is quite substantial.

Table 35. **Contribution of post-graduate students to total university research effort: Estimates for selected countries**

	Total researchers, scientists and engineers, in thousand FTE (1979)[1]	Post-graduate student research, in thousand FTE[2]	
	A	B	[B/A]%
United States	82.6	34.4 (1980/81)	42
Sweden	3.5	1.0 (1978)	29
United Kingdom	12.4	10.4 (1977)	84
Finland	1.9	0.4 (1980)	21
Netherlands	4.0	1.3 (1978)	32

1. FTE = full-time equivalent. Figures from *Science and Technology Indicators*, OECD, Paris, 1984.
2. Estimates are based on the number of doctoral degrees in the sciences and engineering awarded in the given year. It has been assumed that research leading to a doctoral degree requires three years of full-time research.

The relevance of these figures is of course simple. If numbers of research students were closely tailored to economic demand for PhDs, it is doubtful, to say the least, whether the university as an institution would be able to meet the growing demands upon it in terms of research, education and service to the community. There are, however, other policy conclusions to be drawn from this survey of employment, which relate more to the nature of the PhD. These are taken up in Chapter 9.

The situation with regard to master's degrees (or other comparative post-graduate specialisation) courses is somewhat different. The expansion at this level, which was shown by

the data of Chapter 2, is a combination of a number of phenomena. For a part it reflects changes in knowledge: expansion in what it is thought the competent professional must know beyond what can be included in the (relatively inflexible in duration) first degree. For a part it embodies something of the gap between education and employment: the range of occupationally-relevant specialised skills which the employed professional must master, but which may not be viewed as relevant, or appropriate to the first degree. In many countries, and particularly in those where sensitivity to "market forces" (especially on a regional or local basis) is built into the system, provision of master's degree courses has closely followed employer needs. But not only employer needs directly. Attention has already been drawn to the tendency (especially marked in the United States) to enter post-graduate training *after* some years of professional work (and the *condition* of some business schools that entrants have this experience). Here occupational requirements are expressed rather by the employee or the professional him or herself. The connection to specific employment possibilities is clearly quite different here from the general orientation to academic life generally associated with doctoral training.

Chapter 8

THE CHANGING STRUCTURE OF POST-GRADUATE STUDIES

The developments which this report has charted, with the exception of the expansion of master's programmes, have mostly been less the result of policy initiatives than of the aggregation of innumerable individual decisions. Beyond a certain shift in the availability of financial support from public sources, and a certain concentration on support of fields deemed economically important, government authorities have exercised little *direct* influence on the shape and structure of post-graduate education in the period covered by this report. Changes in the parameters which characterise the shape and structure of post-graduate education have, far more, been themselves determined by policies framed with other goals in mind. General policies towards higher education, decisions as to the fees of overseas students, availability of project funding for research, the labour market for research-trained manpower (itself a consequence of R&D but also of general economic policy): these, rather than a post-graduate education policy *per se*, have been the dominant influences. However, as pointed out in the Introduction, post-graduate education *in itself* is becoming a focus of concern in many OECD countries. Inevitably, the initiatives proposed or taken reflect the very different existing structures within the various countries. Nevertheless, underlying these very varying initiatives is a concern which is not so different from one country to another. Essentially, what is often to be observed is the attempt to make research training more "professional", that is, more *predictable* in terms of numbers beginning and successfully completing studies, more *efficient* in terms of the quality of supervision and so in terms of the time needed to complete studies and in terms of a reduced drop-out rate, more *formalized* in terms of accredited possession of clear technical skills, and knowledge of clearly demarcated areas of science.

One form of "professionalisation-directed" initiative is to be found in the Netherlands. Here, traditionally, university students finished their studies by obtaining the degree – and later on also the title of *doctorandus* (literally "one who is preparing a doctorate"). These courses of study lasted sometimes 8-10 years. Graduates who wished to obtain a doctorate prepared a thesis either within or outside the university under the guidance of a professor. Both the initiative and the tempo of research were left to the student. The *doctorandus* is the usual end of university study: relatively few stay on in the university to prepare their doctorate. Those who do, either as junior members of staff, or as "doorstromers" (employed temporarily with the principal intention of writing a dissertation), seem by no means totally satisfied with the research supervision they receive. Recent studies suggest that 50-60 per cent are "satisfied", and one shows that only 38 per cent claim to learn much from their supervisors. Despite small numbers and the fact that most are actually employed in the university, many fail to complete. A study in the arts faculty of one university showed that only 20 out of 45 promotion places had led to a doctorate ("promotion") in the past ten years. And when they do receive their doctorates, Dutch scientists are relatively old: the average age is 36.

Concern to change the situation dates from the mid-1960s, when some began to feel that the length of university study could be shortened from the usual 8-10 years. The first proposals in which the seeds of the present reforms can be discerned date from 1978, when the government introduced the notion of a "two-phase structure". The proposal was that the existing education would be condensed into a 4-year course (this is the first phase); thereafter a limited number of students (the initial proposal was 40 per cent of those graduating from the first phase) would be admitted to one of four second-phase options. These were: medical training, teacher training, so-called "professional training", and research training. The universities objected to these proposals, on the ground that the first phase was too short and too inflexible, that the content of the second phase was vague, and that there should be no selection between the two. In the course of discussions, which lasted some years, small changes were made. A new law was passed in 1981, and the first students entered the new 4-year first phase in 1982. The new second phase is scheduled to receive its first students in 1986, but what precisely will then happen is still under discussion. Legal arrangements with respect to research training were submitted to the parliament. As regards professional courses, discussions with representatives of industrial organisations on the subject of joint financing are taking place. The research training was to have been available in all faculties and to have lasted for one year. It was to have consisted of a mixture of further specialised education and research training.

What is also new in the proposals (about to be implemented) is the establishment of a new status for the graduates preparing their doctorate, the so-called "assistants in training" (AIO). These will be paid for 4 years, in which time they are expected to write their dissertation. Other tasks (notably teaching) will be permitted, but must not take more than 25 per cent of the work time. The Minister's plan at present is that by the 1990s, a minimum of 1 500 AIO places per year would be created, reaching a total of 5 000 places across the whole university system. The implication is that some 10 per cent of graduates would thus be accommodated. So far as the university community is concerned, the AIO concept has not found universal favour. In the arts faculties, for example, the notion that research consists of a set of teachable skills is far from accepted. At the same time there is concern over the need to provide the structured institutional framework within which, it is recognised, research training would have to be given if an adequate dissertation could be prepared in the limited time. A few initiatives from the university side are addressing themselves to this structural problem with proposals for post-graduate institutes, somewhat modelled along the lines of the American graduate school – though possibly involving co-operation between different sciences; that the salaries to be paid AIOs should vary in relation to possibilities in the labour market; and (from the Central Employers Organisation) the suggestion that there should in fact be two parallel research training schemes. Their proposal is that 25 per cent of natural science graduates should be given AIO places, of whom 10 per cent should go to the planned 4-year course and the other 15 per cent to a 2-year course not leading to a doctoral dissertation. They propose further that courses should be partly organised in industrial laboratories. Many uncertainties remain. Among these are the savings that might have to be made in order to finance the new scheme; the criteria for allocating AIO places between institutions; and what, if anything, can be salvaged of the initial ideas for a second phase.

In Greece, too, a law of 1982 envisaged restructuring the doctorate. The traditional system in Greece has been that the condition of access to the doctorate was possession of a first degree (licence). No formal arrangements existed: the candidate prepared his dissertation alone or in informal contact with a competent professor. Although a number of faculties offered a one- or two-year post-graduate certificate, this was not a criteria for admission to doctoral study. There has also existed a higher "aggregation": simultaneously an academic

title and a university rank. Only those having the doctorate have been permitted to seek the aggregation. The 1982 reform envisaged abolition of the aggregation, and formalization of processes leading to the doctorate. A new post-university diploma (intended as equivalent of the French DEA or the Master's Degree in Anglo-Saxon countries) is to be a necessary requirement for admission to doctoral study. The doctorate would be prepared in new structures within the universities, called "*Facultés d'enseignement de troisième cycle*". However, by the end of 1984 these Faculties had not yet been established, and both conditions of access and functioning remained uncertain. Turkey has gone along a similar road. The law of November 1981 established post-graduate institutes with formal admission criteria, regular course, etc. The system is now working and one quarter of the 20 000 enrolled are preparing their PhDs. Reforms planned in Greece and the Netherlands are somewhat in line with the structure of studies which has existed in France for ten years or more. This is particularly the case with the initial two-phase proposals of the Dutch government, involving a variety of second-phase options. In France, the system in the period under discussion in this report (itself the result of successive modifications through the 1960s and 1970s) has been roughly as follows. Following the end of "undergraduate" studies (first two cycles, leading to a *maîtrise*), there have been two third-cycle options for students wishing to remain in the university. These are the *diplôme d'études approfondies* (DEA), a one-year research training required for admission to doctoral study; or the *diplôme d'études supérieures spécialisées* (DESS), a one-year specialised advanced training intended to prepare the student for a professional career. (There are at present a considerable number of DESS in fields such as electronics/informatics, clinical and pathological psychology, law, local administration, personnel management, business, and so on). The DESS, it is generally agreed, has been a considerable success. In addition to these formal study streams, the traditional French doctorate – the *doctorat d'Etat* – has been available for those having devoted some considerable time to the preparation of a major scientific work (it was not uncommon for preparation of the *doctorat d'Etat* in humanities to take 15 years). The third-cycle doctorate (or in engineering the *diplôme de docteur-ingénieur*), was to have taken 2-3 years after receipt of the DEA. Reforms at the end of 1984 have introduced major changes to this system. Only the DESS remains untouched, as an effective vocational alternative to further training for *research*. In brief outline, the reforms announced in 1984 involve: abolition of the *doctorat d'Etat* (which is no longer seen as fulfilling a useful purpose); modification of the regulations governing preparation of the now single type of doctorate; and introduction of a new qualification at a higher level called *habilitation à diriger des recherches*. Despite anxiety in the university world – fearful at what appears to be reduced autonomy – the reforms have been introduced relatively smoothly. Some of the factors which appear to have played a significant role in the new policy deserve mention. Certain of the reasons derive from the general intention underpinning all of the national initiatives in this area: the attempt to make the production of a doctoral thesis a more efficient matter. But in addition, and clearly of importance in the new French reforms, has been the wish to make the qualification given at the end of doctoral study comparable – and indeed competitive – with the PhD in Anglo-Saxon countries. What is sought is not only a degree which corresponds to the PhD, but one which will be attractive and useful for students, particularly from Third World countries. It is noteworthy that whereas the United States has drastically reduced the attractiveness of study in Britain – at undergraduate and post-graduate levels – through its differential fees policy, the French government has reformed the very structure of qualifications with, among other intentions, the wish not to discourage students from these same developing countries. Moreover, unlike the previous doctorates, the new doctorates are to be awarded by the individual university *in its own name*. It is sought by this means to introduce a degree of

competition between the universities in terms of standards and marketability of qualification. Important aspects of the reforms introduced, in the light of these desiderata, are spelled out by the Minister in letters to the University Presidents. In his letter of October 1984 relating to the organisation of third-cycle studies the French Minister insists that universities organise their post-graduate education in the framework of a *Projet cohérent relatif au 3e cycle*, so that what is offered both in terms of DEA/doctorate *and* DESS should relate both to each other and to the general research orientations of the particular establishment. Most importantly, only where an adequate *groupe de formation doctorale* exists will universities be permitted to offer the DEA. The attempt is made to *ensure* that the student will work in an effective and appropriate environment, and this is to be achieved through linking together research groups (some of which may well be in the CNRS or industrial laboratories), so that training will not be over-specialised. Moreover, research must be of a high standard, and the formations established must bring together an adequate number of students.

> " *Graduating within a group of doctoral students with teams and research laboratories well structured and of high quality.*
> The new DEA studies must imperatively be based on solid and recognised research teams, and more specifically on teams and workshops linked to the renowned research bodies (such as CNRS, INSERM, and others) or recommended by the Research Department of the Ministry of Education. These teams should give students both a scientific environment and real guidance.
> The doctoral study group within which the DEA (then the doctorate) is being prepared, has therefore several component parts:
>
> 1. Those responsible for the organisation of training and teaching for DEA or post-DEA degrees, including the person giving the course and possibly one or several of his assistants.
> 2. The research teams directly involved in the relevant training, very often including the teachers themselves, and generally located within the institution.
> 3. Finally, research teams that are connected to the previous teams and that are frequently located elsewhere (for instance in universities, schools, firms, etc.) and that co-operate with the doctoral study group on the basis of specific regulations. This kind of co-operation materialises in the organisation of traineeships and recruiting those students who prepare their thesis. It can also be extended internationally (Europe, developing countries, etc.)".

New French legislation also introduces the title of *habilitation à diriger des recherches*, which is henceforth a necessary qualification *i)* to be a candidate for a post of professor and *ii)* to act as supervisor of students preparing their doctorates. To supervise the preparation of doctoral theses, a scientist must now show proof of achievement in original research, a capacity to develop a research strategy, and a capacity to supervise young researchers. The *note de présentation* issued by the Ministry indicates that:

> "The qualifying is not an end in itself to a study cycle and is not obtained through a tutor's guidance. It is awarded by the institution on the basis of the candidate's work (thesis, publications, conferences, contracts, patents, artistic or technical creation, etc.). It thus takes into account the whole of a candidate's scientific activity, rather than the limited framework of a thesis.
> Before it is submitted to the board members, the candidate's record will be examined by at least three rapporteurs, two of whom not belonging to the institution's teaching force, and one selected by the institution's director or president from a list of three personalities

proposed by the *Conseil supérieur des universités*. This should warrant the quality of the applicant's record.

Finally, the board will judge, on the basis of the candidate's work and activities, and especially the interview, whether he or she is able to conceive, lead and co-ordinate research and development activities."

In other OECD countries doctoral study is also in course of evolution, though the process is marked less by the radical changes to be observed in France or the Netherlands than by a process of marginal and evolutionary adjustment.

In Germany, the Science Council *(Wissenschaftsrat)* has recently (January 1985) proposed the establishment of post-graduate colleges *(Graduiertenkollegs)* as a supplement to the traditional means of supervision of trainee scientists. A post-graduate college is to be formed through the co-ordination of their activites by a number of scientists, generally in one university, so as to provide an environment for co-operative training. Courses would be given within this scheme. At the same time, the German Science Council envisages that establishment of such "colleges" would be connected with the establishment by a university of its priorities in research. The general thrust of these proposals obviously has something in common with French and Dutch developments. The underlying objectives, as indicated earlier, are however comparable.

In Britain the policy of the Science and Engineering Research Council – for example through its Cooperative Awards in Science and Engineering (CASE) scheme – has for some time been to seek to involve industry in the furtherance of a certain number of PhD projects. More recently, the Economic and Social Research Council has developed a scheme for associating a certain number of PhD students with established faculty research projects: to seek to overcome the traditional "isolation" of the post-graduate student in many social sciences. In Switzerland the universities of the French-speaking cantons have for some years provided third-cycle education in the framework of a collective agreement, so that in certain fields post-graduate education is organised collaboratively. This system, designed to overcome the fragmentation of the higher education system and to permit a certain inter-university mutual assistance, seems to have worked best in physics. In other fields, such as theology and law, there seem to have been major difficulties. The list of fields covered by this convention is in process of change. In the United States, with its multitude of academic institutions, many new initiatives are being taken, some of which amount to a radical rethinking of the very nature of doctoral study, particularly in the context of current concern with university-industry relations[3]. At the University of Texas, Arlington, a programme leading to the Doctorate of Science in applied chemistry was introduced. The study plan involves a broader range of courses in applied chemistry and related areas. It requires a period spent in industry, and a dissertation involving both chemistry faculty in the university and scientists in industry. Much emphasis is placed on the ability to communicate across disciplinary boundaries. At the University of Texas, Dallas, a new doctoral programme in chemistry goes further. The traditional dissertation is no longer required. Instead, students will complete three "research practicals", each lasting 6-12 months. One of these is to be done in industry, the other two in two different laboratories under different supervisors. The university seeks to develop breadth and flexibility rather than highly-specialised research competence. Clearly this is a totally different notion of the objective of a doctorate: one far away from the preparation for a life in scholarship which still finds its place in many European universities (as well as some in the United States). However, even in Britain the recent Working Party on Post-graduate Education felt obliged to defend the *thesis* as the traditional end point of doctoral study.

"It is a platitude that a course of research training must include some research; but how much? The obvious answer is as much as can be fitted into the time allowed. In the

natural sciences this raises no problems; research can be broken up into pieces of moderate size, and in the three years which is generally accepted as the proper duration of a course of research training one can complete one or more pieces of research. But in the social sciences research comes in much larger units, and in some areas it may well not be possible to produce a completed piece of research in three years or anything like it.

This leads on to the nature of a thesis and the need for it. In the natural sciences, the ability to write a connected exposition of 150-200 pages is not in fact an ability which one needs in order to do research. But it is an ability which will be needed in almost every job (whether in higher education or outside) to which a course of research training should lead. It is not an ability which anything in the undergraduate work of a natural scientist is designed to produce; so it has to form part of a course of research training. This is precisely what writing a thesis does – and a thesis in the natural sciences normally is and should be not just an exposition of a piece of research but also an exposition of the area of knowledge into which that research falls. This is why completion of a thesis is so important in the natural sciences; it is not merely evidence that the candidate has successfully been through a course of research training – it is an essential part of the actual training. On the other hand, to a natural scientist a thesis is a somewhat unnatural object; it does not resemble anything that plays an essential part in the process of advancing knowledge. This is why the average research student dislikes writing up a thesis, puts it off as long as he can, and avoids it altogether if he has any plausible excuse."[5]

It is difficult to avoid the conclusion that the growing attention of policy-makers to post-graduate education coincides (accidentally or not) with a now almost critical uncertainty as to what education in research, and the doctorate, *should be*. How far is it possible to go, in terms of "efficiency", "relevance" and yet preserve anything of the scholarly traditions?

The situation is, in fact, still more complex, and a number of different perspectives can be distinguished, each with its protagonists. First, there are those who see doctoral study as essentially the preparation for an academic career – or more accurately, for a life of scholarship. (The two are not necessarily the same). Such preparation must remain an apprenticeship in scholarly enquiry, with consideration of efficiency, manpower planning, and the like. Second, the view often expressed by governments and their advisors is that whilst the fundamental objective of doctoral study is not in question, the manner of its attainment requires more scrutiny. This leads to greater concern with control, efficiency, effectiveness, some form of manpower planning, and so on. It may often be argued, on this view, that doctoral study has been over-expanded relative to employment possibilities, or that provision in some fields must be expanded at the expense of others. Third is the less formalized view which calls into question the very nature of traditional doctoral study. Here, almost exclusively in the United States, one finds attempts to develop new forms of doctorate which are not fundamentally structured around the construction of a knowledge claim. Such innovations are to be found essentially in domains of activity where there is no clear demarcation between science-derived problem-solving and practice-derived problem-solving. Medicine is of course a traditional illustration of precisely this phenomenon. It is perhaps no accident that the research content of the MD requirement is often minimal. Industrial research, with its frequently different constraints from those of academic research (and, as a consequence, different criteria for judging an optimum problem solution), is another example. Policy analysis (and especially the more radical demands for a policy science which have sometimes been made) stands in a similar hard-to-describe relationship to the social sciences. This perspective has no clearly demarcated body of adherents, but is expressed within the

universities by individuals who have difficulty in fitting themselves into existing study programmes, and by independent commentators. These three perspectives – doubtless with many local variants – are not immediately compatible with one another. Their interplay shapes current debate as to the nature of doctoral education.

Chapter 9

SUMMARY AND CONCLUSIONS

Post-graduate education in general, and the apprenticeship in research leading to the doctoral degree in particular, have always been to some extent shaped by the interaction of policies directed on the one hand to the higher education system, on the other to the research system. The interactions between these two sets of policies, with their different priorities, have often been fortuitous and unpredictable. Post-graduate education was not, until recently, a focus of policy concern *in itself*. The past decade and a half, on which this report has focused, has been one in which the higher education growth of the previous period ended or turned to decline, and in which the previously lavish funding of research gave way to concern with efficiency, with "relevance", with the establishment of hard priorities. Both of these developments have had their effects on the scale and the "shape" of post-graduate education.

Doctoral study, whether marked by achievement of the "PhD" which many countries took over from Germany at the beginning of this century, or by the award of some other less professionalised title, has traditionally been seen as the process of preparation for a career in the university (or an equivalent and closely-related research structure). Through most of the 1970s and into the 1980s these careers have scarcely been available in most OECD countries (though with few exceptions). In many countries this trend is likely to continue, whether for financial reasons or for demographic ones. The result seems to have been that, in some countries at least, the *best* of graduates have foresaken post-graduate study. There is a suggestion, at least in the United States, that universities have had to lower their standards in order to fill their graduate schools. Moreover, it appears that in the United States – though as yet nowhere else – universities are beginning to face competition in the provision of post-graduate training. The emergence of the "corporate classroom" may indeed represent a response to a growing demand for post-graduate training which seems relevant to possible employment opportunities. Statistically, few OECD countries have experienced growth through this period. Australia and France are among the few where post-graduate enrolments have actually risen. It is significant that in Australia, where employment possibilities in the private sector have not made up for those lost in the universities, new PhDs leave the country to the extent of 20-30 per cent per annum. But largely speaking, growth (or relatively restrained decline) has not been due to research training leading to the PhD, but to a constant or increasing demand for post-graduate *specialisation courses*, particularly in areas relating to computers, management, business.

If one looks deeper into the structure and composition of the student body, it is apparent that this too is changing. To some degree this represents the changes in the composition of the undergraduate population which the national case studies chart. From these it is clear that policies to increase the share of women among university students (combined of course with

rising aspirations of women themselves) have had their effect, and many (though certainly not all) countries now enjoy something approaching equality in gender distribution among their student populations. Similarly, there is an ageing of the general student population, brought about in part by policies for the admission of mature students (though not in Germany or the United Kingdom), and partly by stretching out of studies, perhaps stimulated by absence of career perspectives. These developments, and others more limited to specific countries, naturally have their effects on the population from which the post-graduate entrants are to be recruited. Of course there is no direct and immediate correspondence. Women students do not tend to seek to go to post-graduate study to the same extent as men, and older students are similarly less likely to continue their studies still further. Nevertheless, parallel developments are to be found at the post-graduate level. The share of women pursuing post-graduate study seems everywhere to be rising. Whilst actual percentages vary enormously (from around 13 per cent in Japan, to 25-35 per cent in Australia, Finland, Sweden, the United Kingdom, to almost 50 per cent in the United States), the trend seems everywhere to be upwards. Indeed, in many places an increase in this percentage has been made a matter of policy commitment. The reasons, however, are typically a blend of, on the one hand, concern with matters of social justice, and on the other, concern with the avoidance of loss of talent. It remains true, however, that women graduate students are typically concentrated in certain fields of study: vastly over-represented in the arts and humanities; vastly under-represented in the natural sciences; scarcely represented at all in engineering. (Thus, in the United States, women received over 40 per cent of PhDs in the humanities, 11 per cent in physical science, 4 per cent in engineering in 1980/81). The fields in which women typically seek their higher degrees are ones which today seem to offer almost no employment opportunities, and in which the successful completion of study is itself problematic. The student body is changing in other ways too. In a number of countries foreign students are making up a larger and larger share of all post-graduate students, though again actual percentages vary enormously. In Australia and in the United States numbers are growing: to the extent that some American educators have expressed concern that certain courses are coming to be virtually monopolised by students who may not remain in the country after completing their study. In France, perhaps more aware than elsewhere of the long-term benefits which may accrue to a nation, there is today an emphasis upon *attracting* more overseas students for research study. Students from Third-World countries in particular should become a larger element in the French post-graduate community. For the majority of OECD countries, especially those where education is given in relatively little known languages, or where academic structures are unlike those of other countries, foreign post-graduate students remain uncommon. Finally, the post-graduate student community is ageing. That is to say, whether viewed in terms of average age or in terms of the age at which a candidate typically receives his/her degree, there is a slow but sure increase. In fact, this increase is taking place largely in social science and humanities disciplines: precisely the ones in which increasing duration of studies (and failure to complete) is a matter of considerable concern. It is far less (if at all) true of the "hard" sciences or of engineering (where in many countries post-graduate students have in any case preferred one-year specialisation courses). In these fields, potential industrial employers have nevertheless frequently complained that newly-trained research scientists come to them at too advanced an age for their taste. It is noteworthy also that where determined efforts have been made, as in Sweden, to reduce the duration of studies, these have not affected this seemingly inexorable process of ageing.

Ageing is to a large degree a reflection of a more fundamental process of increasing study time. Thus, just as it is particularly in the social sciences and humanities that the post-graduate student population is most visibly ageing, it is in these same disciplines that an

equally inexorable process of lengthening of the time taken successfully to complete doctoral work is to be observed. This phenomenon, and particularly in these fields, seems to be occurring in all countries for which data were available. Part-time study (which is more common in these fields) is certainly one part of the explanation (and even in chemistry French data show an unsurprising association between part-time study and longer duration). But this increasing study-time is closely connected to (and partly explained by) the fact that many students actually *never* successfully submit their dissertations. It is not apparent that part-time study would serve as an explanation of what is generally regarded as "failure". The factors underlying the problem of non-completion have been studied in a number of countries (notably Australia, Sweden, the United Kingdom). There seems little doubt that two quite distinct sets of factors need to be invoked in explanation. The first set relates to the individual students. Here, preparation (prior training in research techniques in particular), socio-economic circumstances (the financial possibility of devoting adequate time to research, the presence or absence of major family responsibilities – themselves associated with increasing age) and, perhaps above all, adequate *motivation*, seem to be vital factors. But on the other hand it is clear that a large measure of responsibility for non-completion must be placed at the door of the academic institution. Here, significant elements seem to be the general quality of the environment (an adequate commitment to research within the department – a research "ethos" – involvement of students in collective research-related activities such as colloquia, adequate facilities) and the quality of supervision received (in terms of identifying a suitable theme for study, support, guidance, regular contact, and so on). These studies do suggest that, at the present moment, not all university teachers, and not all university departments, are equally equipped to provide PhD-level education. In the United Kingdom, a recent Working Party of the Advisory Board of Research Councils proposed sanctions against university departments in which completion rates are very low. Their proposal is that universities should be required annually to publish figures showing proportions of students enrolled for doctoral study who complete within 4 years, and that there should be the threat of reducing the supply of research student places (awards) in cases of poor performance. In France, new legislation has implications both for individual university staff and for departments. Only scientists who have proven (to their peers) a level of scientific accomplishment deemed adequate (and considerably above that of the doctorate itself) as well as an adequate personal commitment are to be permitted to supervise doctoral research. Moreover, individual departments will themselves have to be approved by the Ministry before they can offer the one-year diploma (DEA) leading to preparation of the new doctorate. The emphasis is to be on groupings of departments together forming an adequate *groupe de formation doctorale* of acceptable size and research accomplishment.

As stated above, this "non-completion" has generally been regarded as a failure (whether of the student or of the system), and the various studies (and measures proposed) have sought to establish (and counteract) its causes. But this view is not self-evidently correct. There are two alternative views which are sometimes put forward. The first argues that any knowledge acquired is self-evidently good: that "quantum" regarded as equivalent to a PhD has no unique merit. The second argues that failure more accurately represents a failure of the flexibility of the system. A more differentiated set of provisions is required. Some students enter graduate training not in order to complete the training but to acquire a very specific skill in the only available manner, or for some other purpose. Structures of provisions (whether at the doctoral or master's level) have not diversified to the extent to which interests (themselves in part shaped by changing employment prospects) have diversified. The restructuring proposed by French and Dutch authorities, though seemingly radical, are then no more than the search for enhanced efficiency.

Elsewhere this radical restructuring has not been attempted or not been achieved. But clearly, policy bodies now deliberately involving themselves in the problems of post-graduate study can only influence the "efficiency" of the process, or the numbers or distribution of students graduating, where appropriate policy instruments exist. In principle the most available such instrument is the financial one. In many countries having formalized programmes of doctoral study leading to the PhD, significant numbers of post-graduate students are supported through award schemes (operated by research-supporting government agencies). In other countries the preparation of a research degree is typically financed either from loan or award schemes open to all students irrespective of level, or from university *employment* (so that the status is not typically that of "student"). But in countries such as Australia, France, the United Kingdom, the United States, major programmes of post-graduate student support exist. In a number of other countries, such as Sweden, comparable schemes have been introduced on a small scale in the recent past. In no case is the extent of central finance such that overall manpower planning would be possible (even if desired): government award schemes rarely exceed something like one quarter of all students. (Indeed the percentage of students supported from such schemes tends in a number of countries to have declined). However, there is little doubt that this instrument may be used to pursue policies of other kinds. For example, in so far as it is agreed that the quality of the research environment provided by a particular department is an important element in non-completion, there is clearly much to be said for directing awards to departments identified on appropriate criteria. This is in practice what happens in a number of countries (e.g. the United Kingdom) where individual departments are allocated a quota of awards on the basis of criteria of this kind. The same is true in France with the *allocations de recherche* of the Ministry of Research and Technology. Quotas should then reflect the achievement of the department in research as well as the extent to which its former students have successfully completed their studies. (Of course such a desideratum says nothing about the extent to which such awards should be *concentrated* in a small number of departments. Whether or not the number of research students in a given department should be above some "critical size" is a matter on which it is difficult to be certain). Award schemes of this kind are now being used as a means of stimulating research training in fields regarded as of particular importance. In the United Kingdom, for example (where the last years have seen a precipitous decline in the number of research students in the social sciences supported by the Research Councils), growth in numbers of awards is planned almost exclusively in fields like micro-electronics, informatics, genetic engineering. In Sweden, too, the new scheme of similar studentships is limited to certain priority fields.

Awards of this kind are normally made for a restricted period of time, typically 3-4 years. It is expected that in this period of time the student should be able to complete his/her dissertation. Data on length of study, however, show fairly conclusively that in the social sciences and the humanities this is rarely achieved. Whilst part of the problem reflects the large number of part-time students in these fields, the isolated nature of the work (e.g. in libraries) and the consequent lack of social support which group work offers the laboratory student, this is not the whole of the explanation. What is at issue is a matter not only of the "pathology" of study, but of a significant difference in "physiology" also. The research process is fundamentally different in disciplines where the student engages in an empirical study in a laboratory group, and where his topic is closely connected to those of his colleagues, from the process of research in, for example, the humanities. It is not only the presence of a supportive social environment in the first case (where everyone around can be of help), though this is of great importance. It seems very likely that research in the humanities and some of the social sciences is less easily predicted as to its complexity, possibilities, likely duration. There are

inherent uncertainties which cannot be resolved by *fiat*. The fact that an award expires after 3 or 4 years may result only in a situation in which the student is forced to leave with his/her work unfinished – and to enter a new situation in which its completion may be highly problematic. There may be much to be said for a more *differentiated* system of awards. In the social sciences and humanities, in which there is little alternative employment calling the young researcher away, and where it seems clear that many dissertation topics *cannot* be successfully completed in 3-4 years, extra time is needed. In the physical and increasingly biological sciences, where university departments have difficulty in holding the best students long enough (with potential dangers for the reproduction of the university faculty), differential payment may be necessary.

The scope for using available studentship schemes as an effective instrument of a post-graduate education policy has far from been exhausted. This is not to say that there is anything to be said for the approaches to overall manpower planning which were favoured twenty years ago. On the one hand, it became clear that these simply do not work. On the other hand, it should be clear that any such approach would inevitably limit the capacity of the university – through its teaching and research – to meet the other kinds of demands than those of manpower which are addressed to it. It is an irony that the years which have seen university budgets most drastically cut have been the same years which have also witnessed an increase in the number and variety of the demands which governments – and societies in general – have addressed to the university system. One consequence of the decline in resources, of the lack of recruitment which the data of this report demonstrate, is the declining share of new PhDs going to work in the academic system. Evidence from a number of countries shows strikingly that research training is associated with, and reinforces, a preference for a career in academic research or something similar. Statistical information on the employment of "stocks" of doctoral graduates shows patterns which vary greatly between disciplines, and with very large shares of those in humanities and social sciences employed within the academic system. There are few if any other employment possibilities for which this sort of qualification seems desirable or useful.

The labour market situation faced by graduates in different disciplines is far from homogeneous. Those who have completed a PhD in micro-electronics, or biotechnology, or materials sciences, face an array of employers battling for their services. Those with a qualification in chemistry, or the general and established areas of physics and biology, face a labour market which may now be recovering. They will eventually find suitable employment. Those with a PhD in sociology, or philosophy, history, anthropology are unlikely to find a post for which their years of work are any preparation at all, unless they are lucky enough to be able to remain in the education system. It scarcely makes sense to speak of a labour market at all in these fields. This is not to say that research training in these fields is a needless luxury. Quite aside from the now weil-rehearsed cultural arguments, there is another point which needs to be borne in mind. The non-existence of a labour market *may* be evidence only of the short-sightedness of employers. There is apparently evidence from the United Kingdom that employers have little interest in engineers with the PhD degree: they do not feel it is relevant for them. The situation elsewhere (e.g. Japan, the United States) is very different.

The tendency today is towards an increasingly "professionalised" system of doctoral training, based more or less on the system obtaining in the United States. This has many very considerable advantages, in terms of adequate preparation of the student through training in research methods, environments in which collective intellectual activities are possible, and so on. But what is everywhere sought today is a system which seems "efficient" (in terms of costs, time) and which seems "relevant" to the needs of potential employers. Here, as so often in the history of research finance and other matters of science policy, a model which applies to (and

derives from) the natural sciences is being applied unthinkingly across the whole gamut of academic life. If in certain disciplines it is not possible to prepare a doctorate in 3-4 years (without relaxing standards to a degree which could not but ultimately undermine the value of the qualification), and if there are no potential employers, then such conditions are meaningless.

Related to this is another issue which is rarely raised in this context: the distinction which can be drawn between "the life of scholarship" and "the academic career". It is a distinction which few (except academic novelists) care to draw. Yet, of course, the reality is that for few academics is professional life one dedicated purely to the advancement of learning (though many claim to wish it so). Administration, research management, advisory and consulting functions, seeking grants (including from industry), and demands on educational work which are themselves changing are all very significant deviations from a norm which never really had currency in many disciplines. It could then be argued that *neither* the traditional doctorate *nor* its professionalised (read "streamlined") version is an adequate preparation for the modern *academic career*: a career which now comes to appear as another professional specialisation. But a master's degree in "academics" will surely not be the answer until science has been moved from its place at the heart of academic culture. Nevertheless, the dilemma – which has other avatars – is an important one.

The situation of doctoral education today is a confused one. At the one extreme, departments of humanities, for example in the Netherlands, resist the notion of formalized PhD-type training as being something other than and far from their conception of an apprenticeship in scholarship. At the other extreme are departments (such as in Texas) abandoning the traditional thesis for a more fragmented system felt better to prepare for a career in industrial research. Resolution of the problem can only come from perception that the processes are very different from each other: that they have different social functions. The question really needs to be asked once more: can the PhD cover these extremes? Is there not perhaps a case for a more differentiated set of qualifications at the doctoral level: for retaining the "old" or "traditional" doctorate in disciplines where efficient training of researchers for the needs of waiting employers is patently impossible?

Flexibility – or inflexibility – of arrangements is a theme which has arisen at various points in this report. It has been suggested that there is an increasingly differentiated set of needs at all post-graduate levels: up to and including the doctorate. "Managerial" reform, on this view, will solve the problem of failure, of non-completion, but this was not the problem.

None of this denies the responsibility of university departments to provide an effective, supportive, and stimulating environment for their research students. It is a moral responsibility irrespective of discipline. It is a moral responsibility which emerges in acute form with regard to part-time students (who amount to 50 per cent, even 60 per cent, in some fields in some countries). In the industrially-related fields initiatives have been taken to develop schemes of PhD-training in which both academic and industrial scientists are involved. Here the training in some way is thought to be able to bridge the gap between the two sectors. This is done on the basis of some agreement between the university and the firm: the joint status of the candidate is regulated. In the social sciences, or the humanities, where the candidate may have some employment totally unrelated to his/her dissertation topic, the question is very different. Such students may contribute little to the university department to which they are nominally attached, and they may receive little or nothing in return. Frequently they fail to complete their work. The essential argument for arrangements of this kind, which cannot be "regulated", is cultural. Again, the status of these students – and in a sense the status or function of their activity – is again different, and perhaps has to be seen as

such. There should be no confusion between the task of the university to provide an apprenticeship in scholarship on the one hand, and its responsibility to offer social support to cultural and intellectual activity in the community on the other. They are not the same, and their confusion can only lead to dilution of standards. Many of the difficulties of post-graduate education today are to do with confusions: the attempt to hold under one rubric, one set of standards, responsibilities which no longer have more to do with each other than that they all belong to the university. The diversity of provision for post-graduate education has not kept pace with the increasingly differentiated relations between knowledge and society. Post-graduate education today has many functions (some unrecognised), but few titles to award. Failure of policy-makers to separate and provide separately for these functions (which indeed is not unrelated to common failure to perceive the inherent differences in needs and functions of the various disciplines of science) can do nothing more than destroy traditional scholarship on the one hand, and hinder responsive innovation on the other.

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